Hatchery Operation and Management

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Preface

The hatchery industry in the United States has developed within a half century into an important branch of the poultry industry of this country, producing approximately two billion chicks annually.

The future development of the poultry industry is dependent in large measure on the quality of the baby chicks produced by the hatcheries of the nation. The application of known methods of successful hatchery operation and management is essential to the production of quality chicks. Similarly, the application of known business principles is essential to the continued existence of the individual *hatchery as a successful business enterprise. These methods and* principles should be of interest to college students of poultry husbandry and to experienced hatchery operators. It is our hope that this book will serve both of these groups, as well as persons in other phrases of the poultry industry, as a helpful reference guide, and thus benefit the poultry industry as a whole.

Competition in the hatchery industry is increasing and as this business becomes more competitive only the more efficient concerns will survive. Therefore, it behooves hatcherymen to avail themselves of *the latest information in this field and to use that which is applicable* to their operations.

In this volume, an attempt has been made to trace briefly the history of artificial incubation and the development of the hatchery industry in the United States. We have endeavored to include subject matter, data, and illustrations which we consider will be most helpful to hatchery owners, operators, and managers. We have tried to present the scientific background for most of the principles used in the practices of hatchery management, as well as the practical information needed by hatcherymen to operate their hatcheries most efficiently.

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We wish to gratefully acknowledge the fine illustrations received from the many hatcheries, colleges, and publishers listed in the titles of the figures used We are especially grateful to Eric Nisson, Petaluma, California, Joseph Taggart, Cleveland, Ohio, and Eden Booth, Pleasant Hill, Missouri, for the extensive material supplied and used in this book

E M F.
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March 1955

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Development and Use of Artificial Incubation

The literature reveals that artificial means for hatching eggs produced by birds (both wild and domesticated) have been and are used by both birds and man. Birds have used artificial aids to incubation for time unknown, and man has used artificial methods of incubation for more than 2,000 years. It may be assumed that man got most of his ideas for artificial incubation from nature. For a detailed discussion of methods of incubation used by birds the reader is referred to Landauer (1948) in *Storrs Agricultural Experiment Station Bulletin* 262.

An interesting example of birds' not incubating their own eggs is the cuckoo, which lays its eggs in the nests of other birds. It is left to the foster parents to take care of the young.

METHODS OF INCUBATION

Forced Natural Incubation

Various attempts have been made to force both hens and cocks to incubate eggs.

In 1813 Bose reported a technique developed by Mademoiselle Portebois. In order to make either male or female fowl sit on eggs the birds were put into a box so small that they could not move. A cover prevented the birds from rising. These nests with the birds in them were kept in a dark place. With the female chickens, ducks, and turkeys the top board could usually be removed after a day, the birds remaining with the eggs. Males were somewhat more recalcitrant but submitted to sitting on eggs after a few days. The birds were used for three or four successive incubation periods.

This procedure apparently gained considerable popularity, for in 1867 Geyelin, in a report on the poultry establishments of France,

wrote that a system was employed there which he proposed to call "living hatching machine" and that this technique was practiced by specialists ("couveurs") The method was essentially that described by Bose, except that turkeys only were used as sitters The procedure was as follows Nest boxes were set up next to each other along the walls of a dark room Each nest was provided with a few plaster of Paris eggs Turkey hens were put into the boxes, and the boxes were covered with lattice or wire netting After about 48 hours the plaster eggs were exchanged for 2 dozen hatching eggs to each turkey Once a day the turkeys were removed from the nests and force fed At the same time the nest boxes were cleaned The chicks were removed as soon as they emerged from the shells, and new hatching eggs were put under the turkeys The same birds could be used for 3 to 6 months or even longer Some establishments had as many as 100 turkeys sitting simultaneously (2 400 eggs) Geyelin refers to this technique as "the very best and cheapest way of hatching"

Artificial Incubation as Developed by Man

The earliest recorded accounts of artificial incubation are those of Egypt and China, where artificial incubation has been practiced for more than 2 000 years

Egyptian Aristotle, writing of poultry in 400 B C., said, "In some cases, as in Egypt, they are hatched spontaneously in the ground, by *being buried in dung heaps Instances have occurred of eggs being* deposited and getting hatched spontaneously"

The Egyptian methods were held as trade secrets and passed down from one generation to another, constituting a monopoly of no small advantage That they were successful is indicated by the fact that the owner of these hatching ovens was required by law to return two chicks for each three eggs received the excess chicks constituting his toll or remuneration

Automatic controls were unknown, and the attendant judged the temperature of the ovens and the eggs by his sense of touch The same methods are used in Egypt today Fortunately weather conditions were uniform and outside temperatures fairly constant and thus favorable to the operation of incubators lacking automatic temperature controls

De Reaumur whose contribution to artificial incubation will be discussed later is credited with the statement that Egypt should be more proud of her incubators than of her pyramids Replacing the hen hatching her young required more knowledge and understanding of

nature than driving a horde of slaves piling stone upon stone to the glory of a monarch Figure 1-1 shows the arrangement of an Egyptian incubator

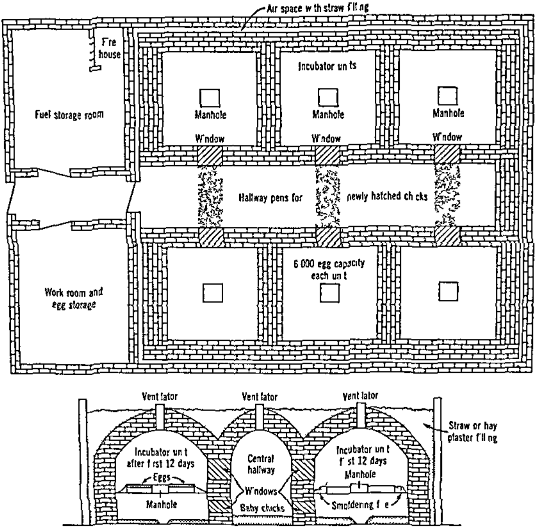

FIG 1-1 Views of a present day Egyptian hatchery (From *Foreign Agr*, May 1953)

El-Ibiary (1946), an Egyptian student at the University of Maryland, presented the following information on Egyptian incubation

The old Egyptian hatching ovens, or "Mamal el firakh' (the chickens *factory*), were known in Egypt since a very long time, where they are considered the backbone of the poultry industry No available reference to the exact time on which they were known, but safely we can state that probably since about twenty centuries this method was known in Egypt

It is interesting to mention here that some of the foreign tourists who visited Egypt during the middle ages, or thereafter, were fascinated by the "queer" method the Egyptians used to get their chicks Some of those old writers claimed that 'all its details are kept most religiously secret"

Some other earlier writers claimed that the attendant used to sit on the eggs until hatching

The hatcheries are built of sun dried brick, mortar and earth Modern enterprises are now built of burnt red bricks, the outer walls are double, the space in between being filled with heat resistant materials, such as dried sand dried silt cotton bolls shells, or chopped straw

The size of plot needed for a hatchery of 8 ovens is about 8 by 20 meters or 160 square meters This is about 1/24 of a feddan (a feddan is about 1 acre)

The hatchery consists of two main sections the incubation and drying section, and the management section

The incubation and drying section consists of the ovens and the median passage which separates the ovens into two groups of equal number This passage is the drying chamber of the incubator

The management section contains (1) dwelling for the attendant, (2) laborer's lounge, (3) egg store, (4) straw store, which is unroofed, (5) small room which is called "Beit El Nar" or the firehouse in which the glowing straw is prepared for the hatchery

Chinese Artificial incubation was practiced in China at least as early as 246 B C The methods developed in China have been adopted in Southeast Asia and the Philippines

King (1911) after visiting China described the Chinese methods of incubation as follows

> Each incubator consists of a large earthenware jar having a door cut in one side through which live charcoal may be introduced and the fire partly smothered under a layer of ashes, this serving as the source of heat. The jar is thoroughly insulated, cased in basketwork and provided with a cover, as seen in the illustration Inside the outer jar rests a second of nearly the same size as one teacup may in another Into this is lowered the large basket with its 600 hens' eggs, 400 ducks' eggs or 175 geese' eggs, as the case may be Thirty of these incubators (1200 hen eggs each) were arranged in two parallel rows of fifteen each Immediately above each row, and utilizing the warmth of the air rising from them, was a continuous line of finishing hatchers and brooders in the form of shallow woven trays with sides warmly padded with cotton and with the tops covered with sets of quilts of different thickness
>
> After a basket of hens' eggs has been incubated four days it is removed and the eggs examined by lighting, to remove those which are infertile before they have been rendered unsalable The infertile eggs go to the store and the basket is returned to the incubator Ducks' eggs are similarly examined after two days and again after five days' incubation, and geese' eggs after six days and again after fourteen days Through these precautions practically all loss from infertile eggs is avoided and from 95 to 98 per cent of the fertile eggs are hatched, the infertile eggs ranging from 5 to 25 per cent

After the fourth day in the incubator all eggs are turned five times in twenty four hours Hens' eggs are kept in the lower incubator eleven days, ducks' eggs thirteen days, and geese' eggs sixteen days, after which they

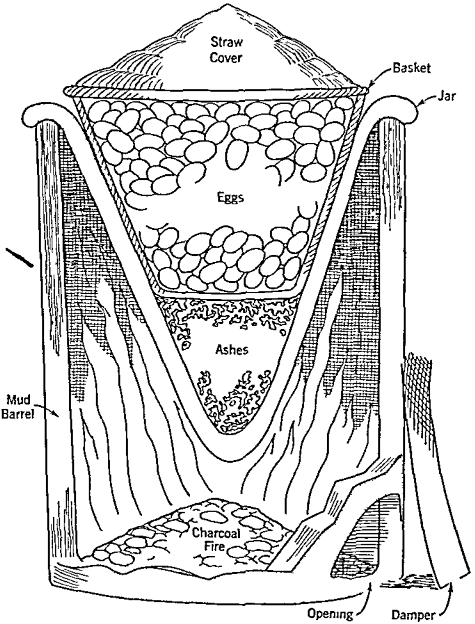

FIG 1–2 A Chinese incubator (From the journal *The Baby Chick*)

are transferred to the trays Throughout the incubation period the most careful watch and control is kept over the temperature No thermometer is used, but the operator raises the lid or quilt, removes an egg pressing the large end into the eye socket In this way a large contact is made where the skin is sensitive, nearly constant in temperature, but little below blood heat and from which the air is excluded for the time Long practice permits them thus to judge small differences of temperature, expeditiously and

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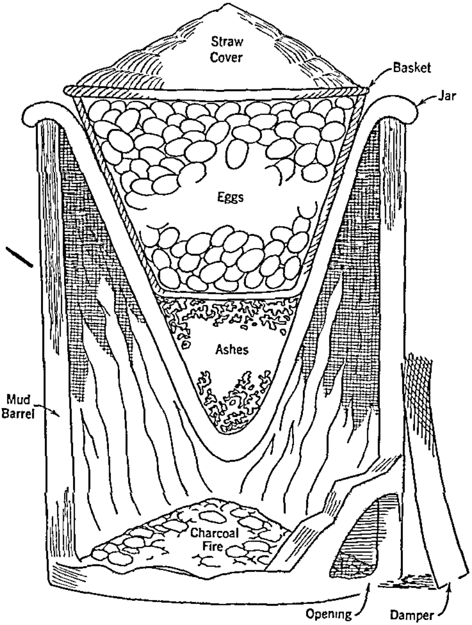

FIG 1-2 A Chinese incubator (From the journal *The Baby Chick*)

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with great accuracy and they maintain different temperatures during different stages of the incubation The men sleep in the room and someone is on duty continuously, making the rounds of the incubators and brooders, examining and regulating each according to its individual needs, through the management of the doors or the shifting of the quilts over the eggs in the brooder trays where the chicks leave the eggs and remain until they go to the store In the finishing trays the eggs form rather more than one continuous layer but the second layer does not cover more than a fifth or a quarter of the area Hens' eggs are in these trays ten days, ducks' and geese' eggs, fourteen days

Figure 1–2 shows the design of the Chinese incubator described by King

European The early travelers from Europe to Egypt were much impressed by the incubators so successfully used by the Egyptians They tried to introduce these incubators into Europe, but the climate was so different from that prevailing in Egypt that the Egyptian incubators never proved satisfactory in Europe

Landauer (1948) states that Frederick II Grand Duke of Toscana, was persuaded by scientific interests to bring two artisans from Cairo to Florence to build and operate Egyptian incubating ovens These ovens were set up in 1644 The first hatch produced 61 chicks out of 144 eggs By experimentation hatching results were improved, but they were never able to raise the chicks successfully

Failure with Egyptian incubating ovens caused Europeans interested in artificial methods to turn their attention to other means for artificial hatching Their attention appears to have been focused upon the Egyptian method of using dung as reported by Aristotle The most famous of these Europeans was the Frenchman, de Reaumur, a leading scientist of his day, who in 1749 published *The Art of Hatching and Bringing up Domestic Fowls of All Kinds at Any Time of the Year, Either by Means of Hotbeds or That of Common Fire* As indicated by the title, de Reaumur employed the principle of fermentation to generate heat for both hatching and brooding chicks His book attracted much attention and was translated into English in 1750 His methods were tested extensively, and as late as 1875 A Corbett was granted United States patent 164,810 for a combination incubator and brooder which was surrounded on three sides by horse manure However, this method of incubation did not prove satisfactory

Soon after the publication of de Reaumur's book which described his incubator, R Huzard constructed, of masonry, a 6 000 egg incubator which he heated with warm water circulated through copper

tubes Moisture was supplied in the egg chamber by water held in open containers

American Incubators The first incubator constructed in the United States was built about 1844 and was patented in England as Cantelo's Patent Incubator It was a hot-water incubator which used charcoal as fuel In 1870 a United States patent was granted to Jacob Graves of Boston for an incubator and artificial mother Some 10 or 12 patent applications pertaining to incubators were made from 1870 to 1883, but beginning about 1883 heightened interest in incubators developed among American poultrymen, and from 1883 to 1925 the United States Patent Office annually received an average of about 10 incubator patent applications

In the April 1883 issue of the *Poultry World* the following incubators were advertised for sale Novelty, Eclipse, and the White Mountain By 1885 these three companies were no longer advertising incubators for sale, but 7 new machines were being advertised in the *Poultry Bulletin* The number of incubators being offered for sale continued to increase The *Reliable Poultry Journal,* January 1900, carried the advertisements of 24 different incubators, and this was about the number advertised in the poultry journals for the next 15 years From 1900 to 1915 about 50 different incubators were offered for sale There were many failures, as evidenced by the advent of new names and the disappearance of old ones The incubators were small machines designed for the producer, and generally the capacity was less than 200 eggs

Because of transportation problems and costs these early incubators were known and sold principally in nearby states or regions In 1895 the Prairie State, made in Homer City, Pennsylvania, was the most popular incubator east of the Mississippi, but by 1900 the Cyphers had become very popular in that region Grant Curtis who controlled the stock of the Cyphers Incubator Company, and was also editor of the *Reliable Poultry Journal,* did much to popularize incubators

M M Johnson was also a successful manufacturer of these small incubators In 1902 he built 2 000 Sure Hatch incubators of 100 to 200 egg capacity In 1903 he announced the Old Trusty, which became a very popular incubator for the next 10 years He employed in his incubator plant at Clay Center, Nebraska, between 300 and 400 workers during the rush season

Competition among the incubator manufacturers was keen, and many unverified claims were made in advertising incubators For example, the Prairie State advertised that their incubator rested on

rubber pads so as to prevent jarring and thus increase the hatch To counteract this advertising and also to demonstrate the merits of the Old Trusty, M M Johnson placed eggs in 3 incubators in a 1 horse spring wagon and drove to the fairs (county and state) in Nebraska, *Kansas, Iowa, and Missouri His settings were scheduled so that the* chicks would be hatching at each stop He invited public officials and newspapermen to view the "miracle," and many articles appeared in the press describing the merits of the Old Trusty incubator

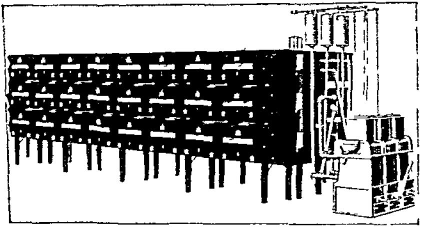


FIG 1–3 Sectional type incubator (From Newtown Incubator Co)

The Buckeye Incubator Company is the only manufacturer of small-type incubators that survived the conversion to cabinet (forced-draft) incubators and was successful with both types of incubators This firm advertised in 1919 that it manufactured 60,000 incubators annually

As in other fields "necessity was the mother of invention" in incubators The farmers and poultry breeders of this period (1880 to 1910) kept small flocks, and thus the demand was for small incubators Society and production generally had not become so highly specialized as it is today, and thus large-scale poultry raising except in a few areas had not as yet created a demand for the production and sale of chicks in large quantities

As the demand for chicks increased and the commercial hatchery industry began to develop, the need for more efficient and larger incubators became more apparent to those who were familiar with the industry The first attempt to meet this new demand was by the building of sectional type incubators The Candee was possibly the first of these machines The Blue Hen, Wishbone, Newtown, Hall,

and MacKay (later Jamesway) were all incubators of the sectional type They were essentially a combination of many small incubators (compartments holding 180 eggs on a single tray) in 1 long deck which was heated by hot water pipes placed above the eggs Later these machines were double and triple decked, and the MacKay had 5 decks Figure 1–3 shows a triple decked Newtown incubator, which was one of the popular sectional machines used by hatcheries in the 1920's After 1925 the popularity of the sectional incubator waned, and the cabinet (forced draft) machines were demanded by hatcherymen The sectional incubators occupied much more floor space than the cabinet (room type) machines and required much more labor for operation than the cabinet incubators Therefore the hatchery industry turned to incubators that were more efficient and more eco nomical of operation

Since the United States Supreme Court in 1937 ruled that Milo Hastings had invented and patented the first forced draft incubator and thereby invalidated the Smith patents, it is of interest to note some of the statements and view some of the photos Milo Hastings sent to Professor H L Kempster about 1912

> The application of mechanical draft to incubation is the basic principle of the Hastings Hatchery Upon this principle rests the inventor's applica tion at the patent office
>
> Though directly an added expense, mechanical draft is the means of great economy and increased efficiency It renders feasible the superimposing of many layers of eggs, greatly reduces the size of the buildings the area to be insulated and the amount of heat radiating surface It gives a superior heat distributing system and does away with the multiplication of varnished cases, glass doors, thermometers and moisture devices It furnishes a real solution to the ventilation and evaporation problems and eliminates 95 per cent of the labor of turning and cooling the eggs In fact it takes artificial incubation out of the empirical arts and places it among modern technical industries
>
> In the future a hatchery equipped with little separately insulated incuba tion chambers each holding a few score of eggs will be just as great an absurdity as would be a cold storage plant with a warehouse filled with a thousand refrigerators each with its leg of lamb or tub of butter
>
> The Hastings Hatchery is built, not manufactured It forms a one story structure about one-tenth of the size of an incubator cellar or house of simi lar hatching capacity
>
> Large room hatcheries have been tried before and have failed because their builders did not know how to overcome the inequalities of heat due to the convection currents of air and gravity drafts set up within the chamber by the difference in temperature of walls eggs or other objects and also

> because with dead air it is impossible to keep large quantities of eggs from overheating in the center of the mass
>
> In the Hastings Hatchery the temperature stratification of air is overcome by forcing through the hatching chamber a mechanically impelled blast of air This rapidly moving air evenly distributed throughout the cross section of its movement by suitable gratings results in a more even distribution of heat within a hatching chamber holding many thousands of eggs than is secured in a single tray of the most perfect dead air machine That this should be so is not at all remarkable when the entire volume of air in the machine passes through the fan every few seconds
>
> The turning system in the Hastings Hatchery is remarkably efficient and simple and would have been invented long ago if adapted to other styles of incubators *The turners are simply compartments containing twenty to* thirty superimposed trays and pivoted on a horizontal axis The bottom of the tray above forms a lid to the tray below and as each row of eggs in the trays is separated by vertical strips the egg is confined in a rectangular box with a cross section approximately two by two inches
>
> This turning compartment being full the door is shut enclosing the chamber on the fourth side but leaving the top and bottom open for the passage of air blast To turn the eggs the chamber is revolved half a revolution and the air passes through the other ways thus equalizing the slight vertical stratification of temperature The chamber must come back to the original when the eggs are to be removed
>
> *The Hastings Hatchery is the most compact automatic and fascinating* machine ever operated in connection with an animal producing industry Moreover it is a reincarnation of the mammoth hatcheries of Egypt with cork insulation and electrical machinery substituted for the mud walls and burning cow dung of the ancient prototype

Hastings also sent Professor Kempster several photos (see Figs 1–4 1–5 and 1–6) which showed some of the operations in the Hastings Hatchery

Mr Joseph I Taggart manufacturer of the Chick Master incubator and formerly of the Smith Incubator Company discussing the development of the room type incubators in 1952 said

> Prior to 1915 there were many attempts to make larger incubators but none were commercially successful For example Charles Cyphers in 1895 built a room type machine at the Truslow Poultry Farm near Stroudsburg Pennsylvania It had several layers of eggs one above the other all in the same stage of incubation and depended upon gravity to circulate the heated air which was supplied from below As a hatcher it was a complete failure It contained very few of the features that later made large incubators a success and only contributed to incubator science in that it showed a method that would not work About 1911 Milo Hastings conceived the idea of a room incubator containing eggs in different stages of incubation some requiring heat and others giving off heat These he arranged at various levels and circulated air about them in an endeavor to maintain a con

FIG 1–4 Interior view of the Hastings Hatchery showing eggs in trays (Courtesy Milo Hastings and Professor H L Kempster)

FIG 1–5 Interior view of the Hastings Hatchery, showing chicks being removed and eggs being set (Courtesy Milo Hastings and Professor H L Kempster)

stant air temperature throughout the mass Note that in this method the *air temperature is uniform all about the eggs, while in the earlier successful* methods they had followed the teachings of the hen wherein they had one layer of eggs that were warmer on top than on the bottom. Also here the *air is circulated by a fan, while in the earlier methods they wished to avoid* drafts Hastings built his first machine in Brooklyn, New York, then moved

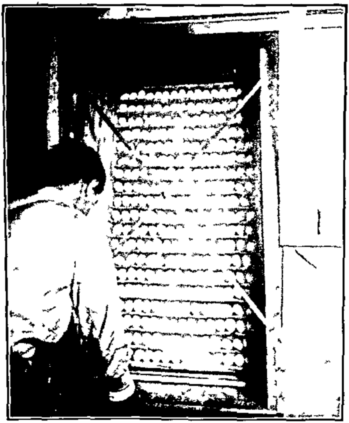


FIG 1–6 Turning eggs in the Hastings Hatchery (Courtesy Milo Hastings and *Professor H L Kempster*)

to Muskogee, Oklahoma, and after a few months to Port O'Connor, Texas, but abandoned each effort within a few weeks and entered other fields of endeavor His general principles, however, proved sound after certain refinements were added At this same time, 1906 to 1915, Dr S B. Smith of Northern Ohio was experimenting with room-type incubators, and in Cleveland in 1915 he perfected one that resulted in what has been called "the Smith method of incubation" It has also been known as the "forced-draft method" On this, Smith was granted a patent in 1918 which stood until 1937 when the courts held the patent invalid because of the work of Hastings

Smith's method differed from Hastings' in that Smith made a refinement of the forced draft principle. *At Muskogee, Oklahoma, which was Hastings'*

best effort, he stacked ten trays 24" wide by 48" long, one above the other in each of seven compartments and then attempted to keep the temperature uniform by forcing air through the seven compartments, said air being supplied by one fan several feet away and with no directive baffles. The trays were not completely filled, but enough space was left at the ends so that the eggs could be rolled for turning. Since air will follow the paths of least resistance, the currents were far from uniform throughout the mass of eggs. Tests show that at some points they would have little or no air movement. This resulted in hot spots and hatches were not uniform. Smith improved on this by using trays 12" wide by 36" long stacked in columns 12 high with approximately a 2" air shaft between the columns. The trays were tilted along the 12" dimension at approximately 40° from the horizontal. In this position there was about 1" air space separating the trays in the column. Smith then circulated the air up these air shafts rapidly enough to keep the temperature throughout the cabinet within reasonable limits. With this arrangement even the eggs in the center of the tray were no more than 6" from the currents up the air shafts, and eddying currents kept the temperature substantially the same about all the eggs in the mass. This refinement made Smith's method a success.

In Cleveland, Smith built and operated the Smith Standard Hatchery (1917 to 1927) which had fourteen incubators, each with 73,000-egg capacity. Also in 1917 Smith and the Buckeye Incubator Company entered into a manufacturers' agreement whereby the Buckeye was to build incubators under the patent up to 10,000-egg capacity (later raised to 16,500), while at the same time Smith would manufacture the larger capacities (25,000 and over). After three years of development Buckeye in July 1920 announced their mammoth incubator, and two years later Smith offered his 47,000-egg machine for sale.

The Buckeye was heated by hot water supplied from a kerosene lamp and the Smith by steam from a coal-fired boiler. Both used standard ventilation fans to circulate the air. In 1923 the Petersime—a 15,000-egg incubator with a reel to agitate the air—came on the market, and was the first mammoth incubator to be heated by electricity. All three of these machines met with considerable success so that during the years of 1923 and 1924 their combined sales totaled about ten-million-egg capacity per year. During the next two years this figure doubled. This was the start of the mammoth incubators in the Western Hemisphere.

Smith, Buckeye, and Petersime were the only cabinet (forced-draft) incubators until 1929 when Robbins and Bundy came into the market with their machines. Bundy introduced the idea of a separate hatcher or separate hatching compartment where chicken eggs were to be placed for further incubation, after 18 days of incubation. This was a new method of incubating and hatching chicken eggs, and it made possible application of different temperature and humidity for hatching than had been used for the first 18 days of incubation. It also provided more space for hatching. This process they patented in

1933 Thus they controlled this method of incubation until 1950 (17-year life of the patent) This principle has been quite widely accepted by the industry

Robbins soon became an important factor in the incubator market because he had a practical incubator of average size (32,000 eggs mainly) which in per egg capacity sold below most other incubators then on the market

Chick Master, which is essentially a modified Smith, is a popular incubator Present-day incubators are shown in Chapter 3

All the early small type incubators were designed to be filled with eggs, and each setting was kept by itself until it hatched The sectional machines used the same method but the cabinet machines were designed to be set twice or more weekly so that each incubator contained eggs in several stages of development The Jamesway Company has incorporated the idea of "single stage incubation" into their large (up to 10,000 eggs), cabinet type incubators Such incubation makes possible any adjustment in temperature, humidity, or other conditions the operator may want to follow during different periods of incubation

DEVELOPMENT OF INCUBATOR GAUGES AND CONTROLS

Devices for measuring the temperature and humidity prevailing in the incubators, as well as the controls necessary for maintaining the conditions desired, were necessary before incubators could be operated successfully Therefore an essential part in the development of incubators was the designing of gauges for measuring temperature and humidity and the provision for maintaining proper temperature, humidity, ventilation, and turning

Bonnemain (1824) described the hot water incubator he had developed He installed a thermostat to control the draft on his stove that was reported to maintain the temperature within about 1°F He also installed shallow pans of water in his incubator to provide moisture

In 1824 Walthew described his 1,100 egg incubator, which he heated with steam

Development of Temperature Controls

One of the major problems man had to solve in developing artificial incubation was the regulation of temperature within narrow limits

The Egyptian and Chinese compared the temperature of the incubator and egg with that of their skin and thus decided whether to increase or decrease the temperature of their incubators In fact the Chinese used the human (old people and invalids) as incubators to incubate and hatch chicks, placing the eggs in bed with them

The first successful effort in thermostatic control was made by the Dutch mechanic Cornelis Drebbel (1572–1633) He built and equipped a hot water-heated incubator with an alcohol mercury thermostat (similar to the present toluene thermostat)

Robert Hooke, one of the founders of the Royal Society of London, described, in 1677, self-regulating lamps he had designed, which could be used for hatching eggs

Bonnemain in 1783 obtained a patent on a bimetallic (iron brass) thermostat, which controlled the draft on his incubator

Progress in artificial incubation was slow, and in 1812 Thomas Jefferson wrote, 'I have wished to see their science (Dr Franklins) applied to the incubation of eggs"

The regulation of the temperature of incubators remained crude and unreliable, and in 1866 Karl Ernst von Baer, the noted German embryologist, complained that the attention required to operate an incubator undermined the health of the operator.

Since 1900 temperature controls have been developed which are dependable and practicable Electric heat made it possible to control temperature accurately merely by making and breaking the electric current by means of a thermostat Figure 1–7 shows the thermometers used on the Chick Master incubator

The development of an accurate thermometer for determining the temperature of the air surrounding eggs in an incubator is of rather recent origin However, Ferdinand II of Toscana in the seventeenth century designed an alcohol thermometer with which to measure temperatures in an incubator He was also credited with designing a hygrometer.

The Control of Humidity

The instruments necessary for measuring and controlling humidity in incubators have only been developed since 1900 Though a hygrometer was developed in the seventeenth century, it was not widely used In fact, only since the start of the century have there been satisfactory incubator hygrometers for determining the relative amount of moisture within the incubator (Fig 1–7)

The more recent and more accurate moisture controls are the ones where the column of mercury in a thermometer makes or breaks an electric circuit, which controls a spray system of introducing moisture into the incubator (Fig. 1–7).

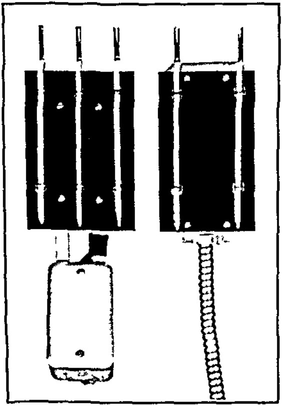


Fig. 1–7. Thermometers used on a Chick Master incubator. From left to right these thermometers control (1) lower moisture limit, (2) maximum moisture, (3) the heaters, (4) the cooling, and (5) the double safety temperature control (Courtesy Chick Master Incubator Co., Cleveland, Ohio)

Ventilation

The ventilation of incubators is not well understood or controlled. Although each company has equipped its incubators with fans or other devices for circulating the air in the incubator and has worked out certain directions with respect to the opening and closing of ducts or holes in these machines, the operator knows little of what he is really doing. He will continue to work in the "dark" until practical instruments for measuring the amount of CO_2 and oxygen in the air of the incubator are developed and made a standard part of incubators. It is also conceivable that the incubator of the future may be equipped

with devices for maintaining an atmosphere containing constant amounts of oxygen and carbon dioxide. Already the need for such controls at high altitudes is evident.

Turning

Man has imitated the hen and after some research decided upon a plan for turning eggs undergoing incubation. Incubators are equipped with electric motors and time switches for turning eggs at regular and frequent intervals. Research in this field may also be expected to yield fruitful results, as our present methods of turning eggs during incubation are based upon limited observations and investigation and are no doubt inadequate for best results. Figure 1–8 shows the mechanism for turning eggs used on the Robbins incubators.

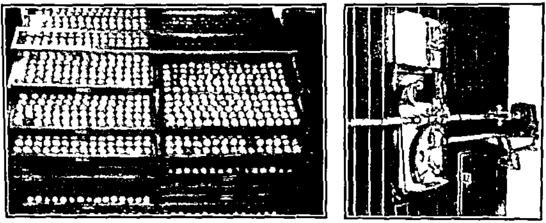


Fig. 1–8. Left, a rack of eggs in a Robbins incubator tilted to turn the eggs; right, the motor-driven mechanism for tilting the egg rack. (Courtesy Mo. Agr. Exp. Sta.)

American engineers and incubator manufacturers have contributed much to perfecting the modern incubator. They have brought temperature, humidity, and turning under control and have partly solved the problems of ventilation. However, there remains research work to be done in determining more exact requirements for successful incubation and in designing equipment to satisfy those requirements.

WORLD-WIDE USE OF ARTIFICIAL INCUBATION

Artificial incubation is more generally used for hatching chicks (domestic fowl) than for hatching the young of other domesticated poultry. However, the use of artificial means (incubators) for in-

cubating the eggs of different species of domesticated poultry varies considerably from country to country. (See Table 1-1.)

Table 1-1 *Artificial incubation for hatching domesticated poultry in different countries* *

% of eggs incubated artificially

Country	Chickens	Turkeys	Ducks	Geese
Argentina	60	30	30	
Australia	95	30	15	0
Austria	60	5	70	10
Belgium	85			
Canada	98	90	75	50
Chile	40	0	14	0
Denmark	95	50	40	40
England	99	98	90	5
France	30	0	4	0
Greece	10	0	0	0
Italy	91	0		0
Northern Ireland	90-95	2	10-20	0.5
Pakistan	5	0	0	0
Sweden	99	90	90	50
United States	97	95	75	40
Uruguay	2.5	1-2	2.5	0

* Personal survey by E. M. Funk.

It was estimated, in 1952, that 95 per cent or more of the eggs of the domesticated fowl (chicken) were incubated in incubators in Australia, Canada, Denmark, England, Northern Ireland, and the United States, whereas in Greece, Pakistan, and Uruguay 90 per cent or more of the eggs of this species were set under hens.

It was estimated that 98 per cent of the turkey eggs incubated in England were set in incubators, whereas in Chile, France, Greece, Italy, and Pakistan all the eggs of this species were incubated by hens.

It was estimated by the Ministries of Agriculture in Canada and in Sweden that 50 per cent of their goose eggs were set in incubators. Most of the countries reporting estimated 100 per cent of the goose eggs incubated by natural methods.

A much higher percentage of duck eggs than goose eggs are hatched in incubators. England and Sweden estimated that 90 per cent of the duck eggs for incubation were set in incubators, whereas in France and Uruguay it was estimated that 95 to 98 per cent of the ducklings were hatched by hens.

2

Development of the Hatchery Industry

The commercial hatchery industry is of quite recent origin, and its development has been phenomenal since the start of the century and especially since the 1920's Within a halfcentury in the United States the setting hen has been replaced by the incubator of the hatchery

There were, however, ancient beginnings or at least ancient counterparts of the present industry M de Réaumur writing in 1749 said,

> The Egyptians, to whom other nations have been indebted for the elements of the greater part of the sciences, have kept one art to themselves, which to this time has been practiced nowhere but among them, *viz*, that of hatching chickens without having the eggs sat on by hens They have a method of building for this purpose long and spacious ovens, very different in their form from those we apply to common uses, these are prepared to receive a very great quantity of eggs, and by means of a gentle and well managed fire they communicate to such as are placed in them a heat of the same degree with that which the hens give so equally to the eggs they sit on After they have been kept warm in these ovens during the same number of days as other eggs must remain under the hen, the period arrives when from each oven above thirty thousand chickens break and come out of their shells at once, insomuch that they are measured and sold by the bushel

M de Réaumur's own method of using hotbeds for hatching eggs in relatively large numbers was essentially a hatchery operation because the production was planned to exceed the owner's needs

The shipping of baby chicks to customers was reported by Sir Edward Brown of England to have been made in England and France many years before such shipments were made in the United States

EARLY DEVELOPMENT IN THE UNITED STATES

Mr. Eric Nisson, veteran hatcheryman of Petaluma, California, writing (1939) of the early history of the hatchery industry of the United States said·

Jacob Graves of Boston built incubators and sold them in the 1870's, and we have a copy of an advertisement wherein he offers not only incubators, brooders, poultry feed, and the like but also chicks "two to four weeks old" This was in 1873, and Graves thus became, so far as we know, the first commercial hatcheryman in the United States, but this did not start the hatchery industry any more than the Egyptian hatcheries did or the couveurs in France who sold chicks hatched under turkeys many years earlier

The hatchery industry in the United States began when conditions within the country were such as to make this kind of business practical, when it fulfilled an economic need The industry grew because of this need, and as it grew it became more efficient in methods and technique, so that its growth was constantly accelerated

Our period of industrial expansion built up our cities and urban population, creating more markets for poultry products With this expansion came better and more economical means of transportation, and poultry became a more profitable crop thus leading to specialization This condition was responsible for improvement in incubators during the latter part of the [nineteenth] century

Since incubators of a fairly efficient type were available, those who began to specialize in poultry made use of them It was natural for neighbors to bring eggs to be incubated and finally to buy chicks, in this way, the hatching industry began

Specialization and concentration in poultry did not, of course, happen over night nor spontaneously over all the country There were localities which, by reason of geographic features, nearby markets, and other favorable factors became areas of concentration

One of the spots where specialization and concentration were earliest developed was Petaluma, California Climate, soil, and natural features were favorable to poultry, and the nearby San Francisco metropolitan area furnished a ready market In this locality there were probably 20 persons who hatched chicks for sale and incubated eggs for a fee by 1900 Some of them are still in the same business

The first of these was C Nisson who purchased his first incubator in 1880 and did considerable hatching for neighbors in those very early days

Other spots of concentration were in New Jersey where much of New York's fresh food was produced It was natural for hatcheries to start there, and Joseph Wilson at Stockton, New Jersey, was the first of these, making his first shipment of chicks by express in 1892 By 1900 he did considerable business in this way Other hatcheries made some shipments prior to 1900, but these appear to be accidental rather than regular

Mr Wilson's shipments proved the feasibility of carrying chicks a considerable distance by express, thus serving a larger group of customers, and a hatchery, provided the egg supply was adequate, might be located anywhere near express facilities

Other areas developed later, and hatcheries were established Zeeland, Michigan, Tiffin, Ohio, and Vineland, New Jersey, were among the earliest and most important

In those first years, a hatcheryman's customers were all near by, none farther away than a fairly easy drive by horse and wagon, so hatcheries had to be located in spots where poultry was concentrated. This also limited the number of hatcheries and their capacities.

Variety in Shipping Containers

The first chick shipments were made in homemade boxes, berry crates, chip baskets, and improvised containers of various sizes and types. Neither the shippers nor carriers had much knowledge of the factors necessary to successful shipping, and both were anxious for the business and they learned.

A. E. Bourke was the first Petaluma hatcheryman to do a regular business in shipping chicks. This was about 1899 or 1900. Mr. Bourke also designed and built practical and efficient wooden boxes for this purpose.

In 1907 a middle western paper company . . . made a chick box of corrugated paper board. This proved popular and its use has since become universal. Boxes of this type, made after the original pattern, were produced by E. F. Adams in Petaluma in 1908. Furnishing boxes to hatcheries is now quite a large industry in itself.

It would be interesting to know who—of all the hatcherymen—first had the courage to guarantee safe arrival of chicks when carried by express. We know that by 1912 it was fairly common practice, and we know also that it had a great effect on customer confidence and resulted in much heavier shipments. The shipping of chicks C.O.D. was another stimulus to shipping, thought out by some enterprising business getter in the early days.

In 1918 baby chicks were admitted to the mails. This widened the market still farther because chicks by mail could reach places not served by the express companies. Then, too, parcel post rates were cheaper than express rates in most cases.

Brooding Inventions Helped

One of the earliest problems to be faced when farmers used incubator-hatched chicks was that of brooding. Mr. Graves (mentioned earlier) sold artificial brooders as well as hens to mother chicks. Other incubator companies also sold brooders. Most of these early brooders were heated with a wood stove. There were also homemade affairs using hot-water jugs or hot bricks, which were just as efficient in most cases as the brooders offered for sale at the time.

The first radical changes in brooding came with the invention of the oil burning canopy brooder, in 1908, by N. Arenberg of Petaluma. A coal stove embodying the same idea came out about the same time. These brooder stoves could be placed in any type of building and permitted the brooding of larger units of chicks. They replaced, pretty generally, the older type of "mother board" brooders and were a factor in the growth of commercial poultry farms.

Improvements in brooding since that time have been largely in management rather than in equipment. Present-day brooders are operated by

fuel oil, gas, electricity, and coal and are more economical in operation and more easily controlled than those of early days

Mechanical Problems

The incubators used by our first hatcheries were lamp-heated, hot air type with capacities rarely over 600 eggs Temperature was controlled by a thermostat acting on a valve in the top of the incubator which opened if the temperature went too high, thus allowing surplus heat to escape Moisture was provided by sponges or pans placed in the incubator, and in some cases the eggs were set in sand which could be moistened The trays were usually of wire cloth or wooden slats, and the turning was done by hand Some of the early incubators used circulating hot water but in other respects were the same

An important first improvement was in using the thermostat to control the flame instead of creating surplus heat and wasting it Bourke (1900) and Lutz (1906) invented regulators for incubators burning gas Studies in heat circulation made possible larger capacity incubators, and these larger types became popular among hatcherymen The greatest improvement, however, was in the operators themselves who learned how to operate these tricky old time incubators successfully

Early attempts to use electricity as a heating element were unsuccessful, chiefly because of the type of resistance wire used J L White of Petaluma is the first commercial hatchery operator we know of to hatch by electricity He had his first successful hatch in 1914 after many failures and experiments His was undoubtedly the first completely electrified hatchery After a better kind of resistance wire was made available, the electrification of the old flat machines became a simple matter

The "Blue Hen" and the "Wishbone" and other makes came out with mechanical turning devices—great labor savers which also promoted better hatches by reason of more frequent turning

Obstacles Encountered

The industry encountered several obstacles that had to be overcome before it could expand The poultry fanciers were opposed to the development of a baby chick industry because they depended upon the sale of hatching eggs and breeding stock for their business Here was a new business which threatened the established and entrenched fancier's business In fact, chicks were offered for sale at prices below the prices at which fanciers had been selling hatching eggs Thus it is easy to understand their concern The following from the minutes of the thirty eighth annual meeting of the American Poultry Association (Reese V Hicks, President), in Atlantic City, August 13–15, 1913, shows how concerned the poultry industry was at that time about this newly developing hatchery industry.

Resolution presented by O L McCord, Danville, Illinois, for W C Pierce, Indianapolis, Indiana

WHEREAS, during the past few years there has arisen a custom of selling and shipping immature chicks generally known as "day-old chicks," and WHEREAS, it has resulted in the following and other undesirable conditions

1 The death of an extraordinary number of chicks through exposure and other improper and unnatural treatment

2 Unusual difficulty in rearing the chicks which survive

3 Weakened vitality and the dissemination of disease which cannot readily be detected at that early age

4 The opportunity for unprincipled persons to hastily dispose of chicks before their health vigor, quality, and value can be determined

5 The deterioration of quality in poultry throughout the country by the practice of indiscriminately buying inferior eggs for hatching and selling the chicks

6 The purchase in department and other stores of such chicks for the amusement of children, and its attendant cruelty, and WHEREAS, chicks when taken from an incubator or hen should be placed in a properly heated compartment, and immediate shipment is therefore cruel, and

WHEREAS, in some cities and states this cruel practice has been prevented by the authorities, and

WHEREAS, health, vigor, and disease cannot be readily determined under the age of about four weeks,

THEREFORE, be it resolved, that this Association in convention assembled recommend to the Department of Agriculture at Washington, D C, and to the Society for the Prevention of Cruelty to Animals, that steps be taken to put a stop to the sale and shipment of chicks under the age of four weeks

And that the Secretary of this Association forward a copy of this resolution to the Secretary of the Department of Agriculture, to the Secretary of the Society for the Prevention of Cruelty to Animals, and to the proper authorities or humane societies of the various states and leading cities

Vice President Peters You have heard the resolution, what shall be done with it? [A heated discussion followed after which the motion was tabled]

Chicks Admitted to Parcel Post

The humane societies opposed the shipping of chicks because they thought it was inhumane to ship chicks and thus expose them to the hazards of weather and deprive them of feed and water This was quite natural opposition because few laymen at the time knew that chicks carried a food reserve (egg yolk) necessary to nourish them adequately for two or three days It was also true that the containers used were improvised and not well insulated or otherwise constructed to protect the chick The opposition of the humane societies subsided

as the baby chick industry became better equipped to handle chicks and the average person knew more about baby chicks

The United States Post Office Department refused to accept chicks as parcel post until forced to do so by the war emergency in 1918 Up to that time the only animal admitted to mails had been the queen bee The postal authorities were concerned not only with the problem of handling the chicks, but they also anticipated requests for other animals to be admitted to the mails This proved to be true

The first president of the International Baby Chick Association, Herbert H Knapp, Shelby, Ohio, writing in the *Reliable Poultry Journal* in March 1924, presented the industry's account of the problem of getting chicks admitted to the United States mail as follows

> The second annual meeting of IBCA was held in Milwaukee, Wisconsin, September 25–28, 1917 It was at this time that the matter of parcel post as a means of transporting chicks was discussed and the following resolution was adopted "Resolved that it is the sense of this Convention that baby chicks and all live poultry and poultry products be included in the parcel post service under such practical regulations as may be provided by the Postmaster General for the speedy and efficient shipment and handling of such products to speed up and conform to the needs of the producers of poultry products at this time"
>
> The Post Office Department had many times in the past ruled against the transporting of anything alive by parcel post Up to this time the only animated thing admitted to the mails was the queen bee, which could be transported without food
>
> In their anxiety to be of service to the entire poultry industry, the Convention had asked for too much and the resolution was not entertained As the months passed the War Department gained full control of the express companies, and the conditions for the transportation of perishable articles and livestock were deplorable and great losses resulted
>
> A committee was called at the Garden Show in New York, January 1918, and an influential and competent man was employed by the Association to go to Washington and make another attempt to interest government officials in the admission of baby chicks to the mails, other live poultry not being considered
>
> After several trips to Washington which were fruitless as far as direct results were concerned this gentleman reported to the writer that on account of the large number of war measures then before the various departments of the government, it would be useless to press the request further at that time It was then the first of March and chick men were already making shipments by express which resulted in thousands of chicks being lost before they reached their destination The majority of the hatchery owners hesitated to open their plants at a time when the government was calling upon poultrymen to increase production

In the meantime, L. D. Allen, a member of the Association and assistant postmaster at New London, Ohio, had interested his postmaster, who was somewhat of a politician and made frequent trips to Washington. He is a man who really broke the ice but on account of lack of information could not present the case. Upon his return home he called the writer by long distance phone, and arrangements were made for an immediate trip to Washington. Through the good graces of Congressman Overmyer, the writer was introduced to Chief Clerk McArdle of the Post Office Department, who in turn introduced me to the secretaries of the various members of the Parcel Post Committee, which was made up of assistants to the Postmaster General.

The greatest objection was from the Fourth Assistant who was of the opinion that to admit baby chicks would let down the bars for all pet live stock and he had visions of monkeys, parrots, alligators, tarantulas, snakes and even bears in the daily mails. As he had the disposition of War Savings Stamps as one of his minor jobs, it was not difficult to persuade him that the 20,000,000 baby chicks that could be sent out would be of potential help in the purchase of War Savings Stamps and would supply food that would take the place of the beef, pork, and mutton then being sent to the fighting men across the water, and to the training camps at home. There could be no sound argument against the proposition. We had a good product that was badly wanted, they had the means at their command to transport it safely. How could they refuse it?

Developing Suitable Chick Boxes

Another problem confronting the infant industry was the development of suitable containers in which chicks could be shipped without undue exposure endangering their vitality or life. Everything from shoe boxes to egg cases was used in shipping chicks. The International Baby Chick Association in 1917 found that the most common container for 100 chicks was a 6 compartment box (18" x 24" x 4½" to 6") in which the bedding or litter was wheat bran, cut clover, hay or straw, and excelsior. The IBCA and the chick box manufacturers developed standard and uniform boxes for 100, 50, and 25 chicks that were readily accepted by the hatchery industry.

Quality Problems

The early industry also had its quality problems. Testing for pullorum disease was unknown before 1913, and after testing procedures were developed the technique was not accepted generally until after the rapid whole blood test or field test was announced by United States Department of Agriculture research workers in 1931. Before satisfactory pullorum testing and control programs were generally adopted, chick purchasers experienced heavy losses in chicks purchased from

hatcheries, because the disease which was quite widespread was transmitted to healthy chicks in the incubators

There was also the person ready to make a "fast dollar" by buying eggs at the produce house or from any producer, incubating the eggs, classifying the chicks by varieties after they hatched, and selling them for the best price they could get Such practices gave the early industry a "black eye," but fortunately the conscientious and honest hatcherymen far outnumbered the unscrupulous and the industry gained the confidence of the poultry producers It should be noted that quality remains a major problem of the hatchery industry

GROWTH AND EXPANSION OF THE HATCHERY INDUSTRY

The hatchery industry of the United States expanded very rapidly between World Wars I and II

Number of Hatcheries

The number of hatcheries increased from about 250 in 1918 to 11,405 in 1934 (Fig 2-1) Since that time the total number of hatcheries in

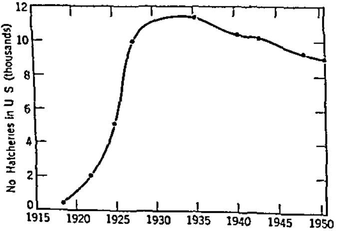


Fig 2-1 Expansion of the hatchery industry in the United States, 1918–1951

the United States has declined However, in some states the number of hatcheries has increased, whereas in others the number has declined The number of hatcheries has increased in the areas where broiler production has expanded The number of hatcheries in New England and on the West Coast has declined (See Table 2-1)

Table 2–1 Number of hatcheries in the United States

State	1938	1943	1948	1951	1951 as a Percentage of 1938
Alabama	99	133	90	98	99
Arizona	25	25	31	21	84
Arkansas	89	107	105	128	144
California	496	387	328	332	67
Colorado	89	89	72	74	83
Connecticut	143	130	132	132	92
Delaware	49	48	29	27	55
Florida	88	96	135	119	135
Georgia	104	147	170	207	199
Idaho	50	50	37	40	80
Illinois	542	440	345	373	69
Indiana	540	451	475	365	68
Iowa	681	624	725	664	98
Kansas	414	360	298	284	69
Kentucky	99	115	132	133	134
Louisiana	37	85	92	94	254
Maine	204	158	128	100	49
Maryland	137	123	104	100	73
Massachusetts	360	325	308	243	68
Michigan	368	274	200	190	52
Minnesota	472	538	425	472	100
Mississippi	55	64	65	83	151
Missouri	417	410	360	435	104
Montana	21	17	22	19	90
Nebraska	259	225	250	173	67
Nevada	4	3	3	3	75
New Hampshire	202	150	170	113	56
New Jersey	213	241	202	170	80
New Mexico	13	15	15	17	131
New York	521	498	372	331	64
North Carolina	130	217	248	239	184
North Dakota	55	65	55	48	87
Ohio	687	597	470	506	73
Oklahoma	215	253	279	232	108
Oregon	187	166	102	104	56
Pennsylvania	592	636	650	575	97
Rhode Island	54	37	31	24	44
South Carolina	66	79	85	70	106
South Dakota	116	126	121	127	109
Tennessee	109	159	128	111	102
Texas	634	615	575	514	81
Utah	27	34	20	20	74
Vermont	54	43	35	22	41
Virginia	172	144	119	129	75
Washington	193	202	206	207	107
West Virginia	62	51	37	47	75
Wisconsin	376	342	350	314	84
Wyoming	11	12	10	10	91
United States	10,531	10,112	9,341	8,839	84

Table 2–2 Hatching egg capacity of hatcheries in the United States

State	1938	1943	1948	1951	1951 as a Percentage of 1938
	(thousands of eggs)				
Alabama	1,774	4,084	3,791	4,464	252
Arizona	716	907	1,100	750	105
Arkansas	2,321	3,827	4,980	6,896	297
California	22,327	18,641	22,354	23,002	103
Colorado	3,575	4,515	4,000	3,900	109
Connecticut	4,386	5,780	7,300	8,430	192
Delaware	2,320	7,002	8,236	9,340	403
Florida	1,698	2,500	4,300	4,852	286
Georgia	2,572	6,668	11,300	15,668	609
Idaho	1,428	1,773	1,542	1,750	123
Illinois	29,811	36,681	37,048	36,757	123
Indiana	28,652	33,596	35,948	35,611	124
Iowa	35,690	43,652	47,324	46,619	131
Kansas	17,034	19,816	20,800	19,500	114
Kentucky	3,576	5,263	6,152	6,571	184
Louisiana	824	1,981	2,247	2,252	273
Maine	1,739	1,886	2,530	3,320	191
Maryland	5,038	9,532	12,755	14,667	291
Massachusetts	5,592	6,828	8,200	8,590	154
Michigan	12,853	13,376	12,000	11,625	90
Minnesota	24,798	35,952	36,600	35,700	144
Mississippi	1,386	1,938	2,448	5,109	369
Missouri	24,713	39,542	42,000	42,600	172
Montana	402	640	1,185	1,370	341
Nebraska	14,230	15,760	16,159	16,940	119
Nevada	80	74	76	76	95
New Hampshire	2,964	3,599	6,700	6,800	229
New Jersey	7,775	10,519	12,100	13,250	170
New Mexico	548	678	698	698	127
New York	9,729	10,804	10,409	11,594	119
North Carolina	3,595	9,393	11,648	12,721	354
North Dakota	1,775	3,243	4,139	3,900	220
Ohio	30,831	30,783	28,500	27,500	89
Oklahoma	7,962	11,500	13,500	12,000	151
Oregon	5,388	4,909	4,500	5,100	95
Pennsylvania	18,909	23,744	25,000	26,000	144
Rhode Island	581	677	860	870	150
South Carolina	1,715	2,568	3,100	3,029	177
South Dakota	4,995	7,717	7,875	8,400	168
Tennessee	3,836	4,707	5,500	5,900	154
Texas	17,914	25,471	27,000	30,000	167
Utah	1,798	1,638	1,242	1,810	101
Vermont	537	407	500	550	102
Virginia	6,504	9,316	12,934	14,603	225
Washington	6,158	5,950	6,800	6,800	110
West Virginia	1,335	1,714	2,197	2,562	192
Wisconsin	12,756	12,873	14,000	13,200	103
Wyoming	236	186	270	250	106
United States	397,376	504,640	551,817	573,896	144

Hatching Egg Capacity

The average egg capacity of hatcheries in the United States has continued to expand From 1938 to 1951 it increased by 44 per cent (Table 2–2) Some believe there is now more capacity than is needed to supply the chicks raised in the United States, and they cite the overproduction that occurred in 1952 with its disastrous chick prices The year 1952 was a poor chick year, but even in years when the demand is heavy the limiting factor in production is seldom incubating capacity but a *limited supply of hatching eggs It should be noted* that much more capacity is needed to supply a given annual requirement of Leghorns than broiler chicks because of the relatively short Leghorn season

Chick Production

From 1938 to 1951 chick production more than doubled in the United States (785,687,000 to 1,782,944,000) Figure 2–2 shows the

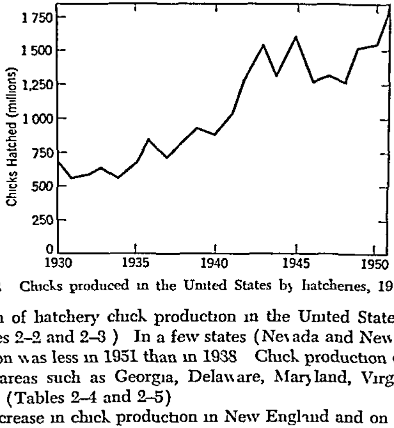


Fig 2–2 Chicks produced in the United States by hatcheries, 1930–1951

expansion of hatchery chick production in the United States (Also see Tables 2–2 and 2–3) In a few states (Nevada and New Mexico) production was less in 1951 than in 1938 Chick production expanded most in areas such as Georgia, Delaware, Maryland, Virginia, and Arkansas (Tables 2–4 and 2–5)

The increase in chick production in New England and on the West Coast was very great The relative increase in the Midwest was not as great as in other areas, but total production continued to be very great in that region

Table 2-3 Average egg capacity per hatchery in the United States

State	1938	1943	1948	1951	1951 Capacity as a Percentage of 1938
Alabama	17,919	30,706	42,122	45,551	254
Arizona	28,640	36,280	35,483	35,714	125
Arkansas	26,078	35,766	47,428	53,875	207
California	45,014	48,167	68,152	69,283	154
Colorado	40,168	50,730	55,555	52,702	131
Connecticut	30,671	44,461	55,303	63,863	208
Delaware	47,346	145,875	284,000	345,925	731
Florida	19,295	26,041	31,851	40,773	211
Georgia	24,730	45,360	66,470	75,690	306
Idaho	28,560	35,460	41,675	43,750	153
Illinois	55,001	82,244	107,385	98,544	179
Indiana	53,059	74,492	75,680	97,564	184
Iowa	52,408	69,955	65,274	70,209	134
Kansas	41,144	55,044	69,798	68,661	167
Kentucky	36,121	45,765	46,606	49,406	137
Louisiana	22,270	23,305	24,423	23,957	108
Maine	8,524	11,936	19,765	33,200	389
Maryland	36,773	77,495	122,644	146,670	399
Massachusetts	15,533	21,009	26,623	35,350	228
Michigan	34,926	48,817	60,000	61,184	175
Minnesota	52,538	66,825	86,117	75,635	144
Mississippi	25,200	30,281	37,661	61,554	244
Missouri	59,263	96,443	116,666	97,931	165
Montana	19,142	37,647	53,863	72,105	377
Nebraska	54,942	70,044	64,636	97,919	178
Nevada	20,000	24,666	25,333	25,333	127
New Hampshire	14,673	23,093	39,412	60,177	410
New Jersey	36,502	43,647	59,900	77,941	214
New Mexico	42,153	45,200	46,533	41,058	97
New York	18,673	21,694	27,981	35,027	188
North Carolina	27,654	43,285	46,967	53,225	192
North Dakota	32,272	49,892	75,254	81,250	252
Ohio	44,877	51,562	60,638	54,347	121
Oklahoma	37,032	45,454	48,387	51,724	140
Oregon	28,812	29,572	44,117	49,038	170
Pennsylvania	31,940	37,333	38,461	45,217	142
Rhode Island	10,759	18,297	27,741	36,250	337
South Carolina	25,984	32,506	36,470	43,271	167
South Dakota	43,060	61,246	65,082	66,141	154
Tennessee	35,192	29,603	42,968	53,153	151
Texas	28,255	41,416	46,956	58,365	207
Utah	66,592	48,176	62,100	90,500	136
Vermont	9,944	9,465	14,285	25,000	251
Virginia	37,813	64,902	108,689	113,201	299
Washington	31,906	29,455	33,009	32,850	103
West Virginia	21,532	33,607	59,378	54,510	253
Wisconsin	33,925	37,640	40,000	42,038	124
Wyoming	21,454	15,500	27,000	25,000	117
United States	37,733	49,905	59,077	64,927	172

Table 2–4 Chick production in the United States

State	1938	1943	1948	1951	1951 Production as a Percentage of 1938 Production
	(thousands of chicks)				
Alabama	4,362	11,048	9,110	23,669	543
Arizona	1,317	3,121	1,070	1,555	118
Arkansas	4,935	15,510	16,068	45,261	917
California	36,464	66,138	69,949	98,132	269
Colorado	6,634	10,943	5,700	8,050	121
Connecticut	18,300	32,859	31,809	44,227	242
Delaware	5,843	42,182	42,076	66,170	1132
Florida	5,322	11,025	13,800	16,930	318
Georgia	6,161	27,950	54,700	104,450	1695
Idaho	2,328	4,698	2,991	4,225	181
Illinois	55,510	116,857	92,250	90,657	163
Indiana	66 662	114,993	84,760	109,589	164
Iowa	67,052	119,828	74,985	86,000	128
Kansas	30,588	51,754	30,250	38,100	125
Kentucky	6,948	14,531	10,100	11,900	171
Louisiana	2,083	7,546	5,076	7,235	347
Maine	4 223	8,208	7,301	20,149	477
Maryland	15,202	49,609	66,342	88,140	580
Massachusetts	14,769	29,060	23,502	35,500	240
Michigan	22,061	39,172	20,500	28,960	131
Minnesota	34,375	74,282	44,500	57,650	168
Mississippi	3,490	7,143	8,800	25,159	721
Missouri	61,189	135,473	82,000	125,000	204
Montana	686	1,610	1,985	2,634	384
Nebraska	24,471	40,103	27,500	33,746	138
Nevada	117	137	95	55	47
New Hampshire	9,318	19,626	26,892	40,651	436
New Jersey	18,306	34,787	26,233	41,000	224
New Mexico	985	1,948	837	962	98
New York	16,050	28,158	22,043	30,336	189
North Carolina	13,084	39,180	38,984	58,890	450
North Dakota	2,470	5 646	4,740	5,810	235
Ohio	59,805	97,277	53,000	64,400	108
Oklahoma	14,567	36,021	20,000	20,800	143
Oregon	6,316	12,098	9,200	16,800	266
Pennsylvania	36,245	77,271	55,800	74,250	205
Rhode Island	1,368	3,709	1,750	1,570	115
South Carolina	3,844	8,384	7,390	11,297	294
South Dakota	8,924	18,666	13,500	15,940	179
Tennessee	8,698	15,883	11,085	17,585	202
Texas	34,992	77,745	51,300	81,518	233
Utah	1,851	2,778	2,170	3,410	184
Vermont	1,324	1,606	1,453	1,872	141
Virginia	15,355	38,291	43,242	63,095	411
Washington	9,079	16,756	19,100	24,225	267
West Virginia	2,922	5,862	6,427	9,962	341
Wisconsin	18,748	31,256	19,100	24,970	133
Wyoming	344	393	425	458	133
United States	785 687	1,609,121	1,262 345	1,782,944	227

Table 2-5 Chick production per hatchery in the United States

State	1938	1943	1948	1951	1951 Production as a Percentage of 1938 Production
Alabama	44,060	83,067	101,222	241,520	548
Arizona	52,680	124,840	34,516	74,018	141
Arkansas	55,449	144,954	153,028	353,401	638
California	73,516	170,809	213,239	295,578	402
Colorado	74,539	122,055	79,166	108,783	146
Connecticut	127,972	252,761	210,977	335,053	262
Delaware	119,244	878,791	1,450,896	2,450,740	2055
Florida	60,477	114,843	102,222	142,269	235
Georgia	59,240	190,136	321,764	501,589	852
Idaho	46,560	93,960	80,538	105,625	227
Illinois	102,446	262,011	267,391	243,048	237
Indiana	123,448	254,073	178,442	300,213	243
Iowa	98,461	192,032	107,427	129,518	132
Kansas	73,884	143,701	101,510	134,154	182
Kentucky	70,182	126,356	76,515	89,474	127
Louisiana	56,297	68,776	55,174	76,968	137
Maine	20,700	51,949	57,039	201,490	1071
Maryland	110,963	403,325	637,903	881,400	794
Massachusetts	41,025	89,415	76,305	146,000	356
Michigan	59,918	142,963	102,500	152,121	254
Minnesota	72,828	138,070	104,705	122,139	168
Mississippi	63,454	111,609	135,384	301,120	478
Missouri	146,736	330,422	227,778	287,356	196
Montana	32,666	94,705	90,227	138,611	424
Nebraska	94,482	178,215	110,000	195,063	206
Nevada	29,250	45,666	31,666	18,233	62
New Hampshire	46,129	130,840	158,188	359,743	780
New Jersey	85,913	144,344	129,866	241,176	281
New Mexico	75,769	129,860	55,800	56,588	75
New York	30,806	56,542	59,255	91,650	298
North Carolina	100,616	180,552	157,193	246,504	245
North Dakota	44,909	86,769	86,181	121,041	270
Ohio	87,052	162,850	112,763	127,272	146
Oklahoma	67,753	142,875	71,684	89,655	132
Oregon	33,775	72,870	90,196	161,538	478
Pennsylvania	61,224	121,495	85,846	129,130	211
Rhode Island	25,333	100,243	56,452	65,417	258
South Carolina	58,242	106,126	86,941	161,385	277
South Dakota	70,931	148,142	111,570	125,511	163
Tennessee	79,798	99,893	86,601	158,423	199
Texas	55,192	126,414	89,217	158,595	287
Utah	68,555	81,705	108,500	170,500	252
Vermont	24,518	37,349	41,514	85,091	347
Virginia	89,273	265,909	363,378	489,108	548
Washington	47,041	82,950	92,718	117,028	249
West Virginia	47,129	114,941	173,702	211,957	450
Wisconsin	49,861	91,391	54,571	79,522	159
Wyoming	31,272	32,750	42,500	45,800	146
United States	74,607	159,129	135,140	201,713	270

Table 2–6 Utilization of capacity (chicks produced per egg capacity)

State	1938	1943	1948	1951	1951 Utilization as a Percentage of 1938
Alabama	2 46	2 71	2 40	5 30	215
Arizona	1 84	3 44	0 97	2 07	112
Arkansas	2 13	4 05	3 23	6 56	308
California	1 63	3 55	3 13	4 27	262
Colorado	1 86	2 42	1 43	2 06	111
Connecticut	4 17	5 68	4 36	5 25	126
Delaware	2 52	6 02	5 11	7 08	281
Florida	3 13	4 41	3 21	3 49	112
Georgia	2 40	4 19	4 84	6 67	278
Idaho	1 63	2 65	1 94	2 41	148
Illinois	1 86	3 19	2 49	2 47	133
Indiana	2 33	3 42	2 36	3 08	132
Iowa	1 88	2 75	1 58	1 84	98
Kansas	1 80	2 61	1 45	1 95	108
Kentucky	1 94	2 76	1 64	1 81	93
Louisiana	2 53	3 81	2 26	3 21	127
Maine	2 43	4 35	2 88	6 07	250
Maryland	3 02	5 20	5 20	6 01	199
Massachusetts	2 64	4 26	2 87	4 13	156
Michigan	1 72	2 93	1 71	2 49	145
Minnesota	1 39	2 07	1 22	1 61	116
Mississippi	2 52	3 69	3 59	4 92	195
Missouri	2 48	3 43	1 95	2 93	118
Montana	1 71	2 52	1 68	1 92	112
Nebraska	1 72	2 54	1 70	1 99	116
Nevada	1 46	1 85	1 25	0 72	49
New Hampshire	3 14	5 45	4 01	5 98	190
New Jersey	2 35	3 31	2 17	3 09	131
New Mexico	1 80	2 87	1 20	1 38	77
New York	1 65	2 61	2 12	2 62	159
North Carolina	3 64	4 17	3 35	4 63	127
North Dakota	1 39	1 74	1 15	1 49	107
Ohio	1 94	3 16	1 86	2 34	121
Oklahoma	1 83	3 13	1 48	1 73	95
Oregon	1 17	2 46	2 04	3 29	281
Pennsylvania	1 92	3 25	2 23	2 86	149
Rhode Island	2 35	5 48	2 03	1 80	77
South Carolina	2 24	3 26	2 38	3 73	167
South Dakota	1 79	2 42	1 71	1 90	106
Tennessee	2 27	3 37	2 02	2 98	131
Texas	1 95	3 05	1 90	2 72	137
Utah	1 03	1 70	1 75	1 88	183
Vermont	2 47	3 95	2 91	3 40	138
Virginia	2 36	4 10	3 34	4 32	183
Washington	1 47	2 82	2 81	3 56	242
West Virginia	2 19	3 42	2 93	3 90	178
Wisconsin	1 47	2 43	1 36	1 89	129
Wyoming	1 46	2 11	1 57	1 83	125
United States	1 98	3 19	2 29	3 11	157

Utilization of Capacity

There is a great deal of variation in the utilization of hatchery capacity in the different states as well as in hatcheries located in the same state (Table 2–6). Hatcheries supplying chicks to the broiler trade are able to operate their capacity over most of the year, whereas hatcheries selling to general farmers or to commercial egg producers have a relatively short season and, therefore, hatch relatively few chicks per unit of capacity The states that rank high in chick production also rank relatively high in either egg production, broiler production, or both (Table 2–7).

Table 2-7 The ten high states in chick production and their rank in egg and broiler production (1951)

Rank in Chick Production	State	Chicks Produced	Rank in Eggs Produced	Rank in Broiler Production
1	Missouri	125,000,000	6	11
2	Indiana	109,589,000	11	8
3	Georgia	104,450,000	24	1
4	California	98,132,000	4	7
5	Illinois	90,657,000	5	13
6	Maryland	88,140,000	29	4
7	Iowa	86,000,000	1	26
8	Texas	81,518,000	7	5
9	Pennsylvania	74,250,000	3	17
10	Delaware	66,170,000	43	2

Percentage of Chicks Raised That Were Hatched in Commercial Hatcheries

The percentage of chicks hatched in commercial hatcheries continued to increase from 1938 to 1951, as shown by Table 2–8 The

*Table 2-8 Estimated percentages of chickens raised in the United States which were hatched by commercial hatcheries, 1938–1951 **

1938	66 1	1946	87 4
1940	71 6	1948	88 2
1942	79 5	1950	91 0
1944	83 2	1951	92 5

* From B A E, U.S D A

shift from hen or small farm type incubator hatching to commercial hatching served as a source of continued expansion in the early days of the hatchery industry But, as revealed by Table 2–7, such expan-

sion is over; the commercial and breeder hatcheries now hatch more than 90 per cent of all chicks hatched in the United States.

POULTRY ORGANIZATIONS

The hatchery industry and its related poultry organizations developed simultaneously. Most of these organizations in the United States developed after the hatchery industry began its rapid expansion. However, the American Poultry Association was organized many years (1873) before there was any hatchery industry.

Poultrymen and hatcherymen have organized many associations, federations, etc., to promote their interests. Some have been short-lived, and others have relatively long histories. Some are local, others state-wide, and still others are national or international in membership. Some were organized to promote poultry improvement, some to serve as trade organizations and to carry on marketing activities.

American Poultry and Hatchery Federation

The trade organization more directly concerned with the hatchery industry is the American Poultry and Hatchery Federation (formerly the International Baby Chick Association) with headquarters in Kansas City, Missouri.

It was organized in 1916 at Cleveland, Ohio, soon after the hatchery industry of the United States began its rapid expansion. The objects of the association adopted at that meeting, which are contained in the present constitution, are: "The objects of this association shall be to foster, promote, improve, and protect the baby chick industry and all branches of poultry husbandry." Individual delegates from the respective APHF state affiliates constitute the Board of Directors. They meet annually, before the annual business meeting and the convention, for the purpose of transacting the business of the association.

The Executive Secretary carries on the work of the association under the broad programs laid down by the Board of Directors and the executive directors. The association has several standing committees which serve as advisory committees: Membership, Planning, Farm Education, Transportation, Disease Control, Fair Trade Practices, and Group Insurance. It also has two administrative committees: Finance and Research.

The association is financed by membership fees or dues collected annually from more than 5,000 members and by the rentals collected from booth space sold at the annual convention. Figure 2–3 shows a

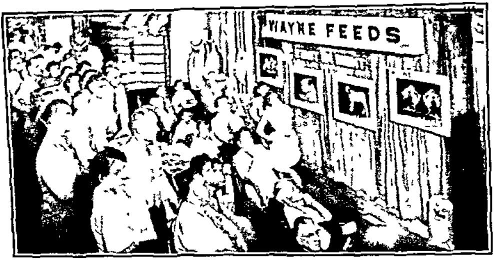


Fig 2–3 A partial view of an American Poultry and Hatchery Federation convention. (Courtesy American Poultry and Hatchery Federation)

scene from an APHF convention. The dues adopted in 1951 were based on hatchery capacity:

Up to 34,999	35,000 to 99,999	100,000 to 249,999	250,000 and Over	Associate
\$5 00	\$10.00	\$20.00	\$25.00	\$15 00

The code of ethics of the present (1952) constitution of APHF reads as follows:

All members of the Federation shall subscribe in writing to the following Code of Ethics:

We possess the greatest faith in the future of the poultry industry. We believe that baby chicks possess the factors of convenience, safety, certainty, and economy in replenishing poultry flocks

We pledge our earnest cooperation with and protection of the public through

Honest, truthful advertising,
Honest, upright business methods;
Honest production and sale of chicks as represented;
We believe in the American Poultry and Hatchery Federation, Inc., subscribe to the principles for which it stands and agree to be bound by its rules, as well as the rules approved for the baby chick industry by the Federal Trade Commission.

This is a statement of principles which should guide all hatcherymen, but it goes without saying that every hatcheryman is on his own honor in carrying out this code of ethics and that some members fail to live up to this fine code.

This association has rendered valuable service to the hatchery and poultry industry of the United States and Canada Since its beginning, it has continued to expand its service to the industry.

It issues a monthly publication, *American Hatchery News,* and an annual directory, *Who's Who in the Hatchery World*

The research program of this association initiated in 1948 gives promise of rendering real service to the hatchery and poultry industry The first product of this program was the preparation and publication in 1949 of the book *Fertility and Hatchability of Chicken and Turkey Eggs*, John Wiley & Sons, New York Financial grants in support of research of direct importance to the hatchery industry have been made annually to state experiment stations The research projects in progress in 1952 were

1 California The Gaseous Environment of the Early Chick Embryo in Relation to Its Later Development and Hatchability
2 Connecticut The Chemical Embryology of Hereditary Traits of the Fowl
3 Cornell Studies to Detect Fertility in Fresh Eggs
4 Kansas A Study of Fertility in Broad Breasted Bronze Turkeys
5 Kentucky A Work Simplification Study of Labor Practices, etc , in Hatcheries
6 Minnesota A Study of the Variant Pullorum Problem
7 Missouri A Study of Optimum Holding and Incubating Conditions for Hatching Eggs
8 Nebraska The Effects of Artificial Diluents, Time, and Temperature on Motility and Fertilizing Capacity of Turkey Semen
9 Oregon Factors Related to Fertility in Chickens
10 Wisconsin Nutrition of Breeding Stock

Poultry Science Association

This is an organization of those engaged in poultry research, resident or extension teaching employed by state, provincial, or national governments in the United States and Canada, and those who have left such governmental positions to enter industry or have by distinguished research work or service been accepted as members

The object of this Association as stated in the Constitution is

> The object of this Association shall be the advancement of poultry husbandry throughout the United States and the Dominion of Canada, especially as it relates to the profession of teaching, both resident and extension, and research

Annual scientific and business meetings are held at agricultural colleges throughout the United States and Canada, at which time papers

are presented reporting the results of research or on subjects of interest to teachers

The association publishes a bimonthly scientific publication *Poultry Science*

State Improvement or Hatchery Organizations

Most states in the United States have one or more state poultry organizations which promote their respective poultry interests Many of these organizations administer at the state level the National Poultry Improvement Plan Some of these state associations are active in holding state conventions issuing yearbooks or lists of members and otherwise promoting their poultry industries

The Worlds Poultry Science Association

This association is semiscientific in that in peacetime it sponsors a triennial congress known as the Worlds Poultry Congress The Ninth Worlds Poultry Congress was held in Paris France in 1951 and the Tenth Congress was held in Edinburgh, Scotland in 1954 The proceedings of these meetings contain the scientific papers presented at the congress

This association also publishes a quarterly journal the *World's Poultry Science Journal* It contains world wide poultry information and abstracts of scientific papers or articles as well as some scientific papers

American Poultry Association, Inc

This association organized in 1873 at Buffalo New York is the oldest poultry organization in America It has served primarily as an organization to promote standard bred poultry in the United States and Canada

The principles adopted by the association at the time of its organization were briefly

1 In each breed then existing the most useful type should be made the standard type

2 No more breeds should be recognized as having distinctive breed character than could be identified readily by at least one conspicuous character or a combination of conspicuous characters not possessed in the same combination by any other breed.

3 Recognition of color varieties in a breed should be limited to plainly distinctive color patterns.

The association revises and publishes at irregular intervals the *American Standard of Perfection*

National Turkey Federation

This is a national (United States) organization of turkey producers whose objectives are stated as follows:

1 To increase the consumption of turkey,
2 To promote legislation favorable to the industry,
3 To assist in collecting and distributing news material, market information, and other information about the turkey industry,
4 To promote turkey research, assist turkey people in getting the best information available on turkey breeding, raising, and marketing methods,
5 To work in every way possible for the best interests of the turkey industry

Beginning in 1949, the Federation began holding annual conventions with commercial exhibits as a part of their annual meetings This association also promotes the Eat-More-Turkey campaign

Institute of American Poultry Industries

This is primarily an organization of poultry and egg packers and processors The objects of the Institute are

1 To promote educational work and develop the interest of the egg and poultry industry for the general betterment of such industry and not for pecuniary profit
2 To afford a means of cooperation with the federal and state governments in all matters of general concern to the industry
3 To promote study of the arts and sciences connected with the production, preparation for market, and marketing of eggs and poultry

This organization stages an annual fact-finding conference, where a program is presented generally designed to keep the industry abreast of the research and progress being made In recent years exhibits of equipment have been featured at these conferences

National Poultry, Butter, and Egg Association

This organization was designed to combine poultry and dairy trade interests It holds an annual convention and maintains a staff to carry on its program throughout the year The objects of this association are

1 To disseminate accurate and reliable information concerning live and dressed poultry, butter, eggs, and other food products
2 To advance and improve commercial conditions in the poultry, butter, and egg trades
3 To foster and strengthen friendly and cooperative relations between poultry, butter, and egg dealers in all parts of the United States, and to

secure improved transportation facilities and just and equitable rates, charges, rules, and regulations for the same

4 To educate and guide public opinion in all parts of the United States to the extent of securing legislation calculated to foster trade and safeguard consumers

5 To settle differences between the several members, and members and non members, and to procure uniformity and certainty in trade usages, and kindred matters relating thereto, as they may from time to time arise

Organizations for the Promotion of Consumer Education

The Poultry and Egg National Board organized in 1939 has developed an extensive program of consumer education with a limited

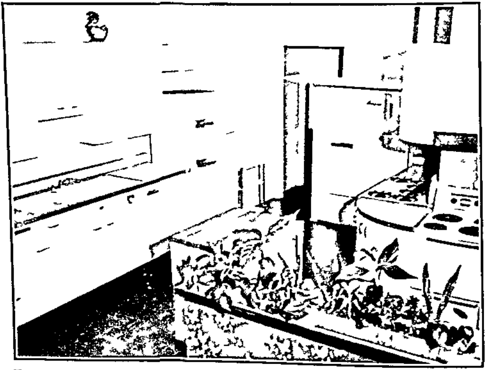


FIG. 2–4 Poultry and Egg National Board Laboratory kitchen for developing new uses and recipes for poultry and eggs

budget (about $280 000 annually) By working with home economists in industry, colleges, and public schools, and with food editors, they have done much to educate consumers in the use of eggs and poultry meat By using this cooperative method the industry has received many dollars in publicity for each dollar expended

This organization is financed by contributions from the poultry industry, chief of which have come from the hatchery industry

The New England Poultry and Egg Institute organized in 1938 has since 1946 been a branch of the Poultry and Egg National Board. It conducts the consumer-education program of PENB in New England.

PENB maintains a well-staffed and equipped laboratory kitchen where recipes for preparing poultry and egg dishes are developed and tested before being released to homemakers. Figure 2–4 shows a view of that laboratory.

In addition to the national organizations discussed here, there are many regional and state trade organizations of persons and firms engaged in handling poultry and eggs.

Cooperative Poultry Organizations

Throughout the United States, there are many cooperative poultry organizations whose primary object is to market products for their members to the best advantage. Some of these associations also serve as purchasing agents for their members. They may specialize in specific products, as the Northwest Turkey Growers Association. They may engage in poultry breeding, chick and poult production, as does the Western Cooperative Hatcheries.

Some cooperatives are organized for the purpose of conducting auction sales of the products of their members.

Some of the general farm cooperatives also market poultry products, and otherwise service the poultry producers who are members of their organizations.

Other Organizations of Interest to Hatcherymen

American Farm Bureau Federation, a national general farm organization.

American Feed Manufacturers Association, a national organization of feed manufacturers.

Association of American Feed Control Officials, an organization of state officials who supervise the sale of feed in their respective states.

Council of American Official Poultry Tests, an organization of those who supervise the state egg-laying contests. They issue an annual report containing a summary of egg-laying tests.

National Association of Commissioners, Secretaries, and Directors of Agriculture.

United States Record of Performance Association, a national organization of U.S.R.O.P. breeders.

3

The Hatchery and Its Equipment

The hatchery and its equipment constitute the physical plant necessary for producing and marketing chicks

TYPES OF HATCHERIES

Hatcheries may be classified in many ways size, delivery of chicks, kind of chicks produced, source of hatching eggs etc Hatcheries vary in size (capacity) from a few hundred eggs to more than one million Some sell all their chicks at the door (local delivery), while others are classified as mail order hatcheries Hatcheries specialize in chicks for broiler production, egg production, or they sell several breeds

Some are breeder hatcheries, primarily poultry breeders who sell chicks, whereas others are commercial hatcheries purchasing all or most of their hatching eggs from supply flocks owned by producers

LOCATION FOR A HATCHERY

The proper location of a hatchery may determine its success or failure The breeder hatchery is usually located on the breeder's own farm Such hatcheries have usually, and especially in the eastern part of the United States, been started on the poultry breeder's farm by the addition of incubators and hatching chicks as a part of the poultry breeder's operations

The commercial hatcheryman has a different problem in location However, some of the things the commercial hatcheryman must consider with respect to location will also apply to the breeder who operates a hatchery Important considerations are the nearby demand for chicks, competition transportation facilities local taxes, and the source of hatching eggs

Demand for Chicks

Successful hatcheries are generally located where there is a good demand for chicks either locally or relatively nearby Since automotive deliveries have become commonplace, hatcheries often serve customers several hundred miles from the hatchery However, there are many advantages in being located near the chick customers

Though few new hatcheries are anticipated in the near future, anyone planning the establishment of a new hatchery should regard the local and nearby demand for chicks as an important factor The kind of chicks in demand should also be carefully considered, whether the demand is for chicks for broiler production, egg production, or for a general purpose fowl

Competition

The kind and amount of competition in the territory should be seriously taken into account The fact that several hatcheries of sufficient capacity are already serving a territory does not necessarily mean that such territory may not be a suitable location for another hatchery There are numerous examples of new hatcheries being established and becoming highly successful while the older hatcheries have closed their business, the reason being that the new hatchery produced better quality chicks and/or had a more aggressive sales program

If, however, the territory is adequately served by hatcherymen who are quality conscious and meeting the demands of their customers, a new hatchery will have difficulty in establishing a profitable business

Transportation

Adequate transportation facilities are necessary for conducting the business of a modern hatchery and should be carefully considered when locating a hatchery Rail transportation, once the prime consideration, now assumes secondary importance, and public highways are now most important Rail transportation remains very important to the mail order hatchery, but the kind of public roads that lead to a hatchery are much more important when it serves a local or nearby market

Air transportation for the breeder or hatcheryman who fills a national or international chick demand is a necessity

Source of Hatching Eggs

The hatcheryman should consider the source of hatching eggs before deciding on a location The ideal location is one near both the chick

customer and the source of hatching eggs, but such an ideal cannot always be attained and the hatcheryman may have to choose between locating near the chick customers or near the source of hatching eggs There are many successful hatcherymen located near their source of hatching eggs servicing chick customers at distant points, and on the other hand there are also many successful hatcheries located in the broiler producing areas which transport most of their hatching eggs several hundred miles

From the history of the development of the hatchery industry in the United States (see Chap 2) the trend appears to be toward hatcheries developing in the areas where the chick customers are located

Labor Costs

Labor cost in producing chicks is becoming more important as wages advance *Such costs are higher in cities and towns where labor is* highly organized The availability of labor and its cost should be considered in locating a hatchery

Location within the Town

The hatchery must be located where there are adequate and dependable utilities A location in the part of town where farmers trade is desirable, if suitable parking facilities are available The trend has been toward locating hatcheries at the edge of town where adequate facilities are available for parking and where the hatchery may be less of a public nuisance Because of odors in hot weather and otherwise unsanitary conditions, some hatcheries have been forced to move from the downtown areas of cities that have rigid sanitary regulations

Figure 3-1 shows an attractive and well located hatchery

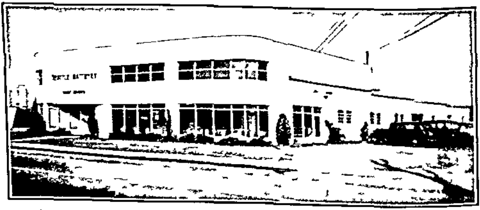


FIG 3-1 An attractive hatchery with parking space beside it (Courtesy Seattle Hatchery, Seattle, Washington.)

HATCHERY BUILDING

The building that houses the hatchery should be carefully planned and well constructed. Many buildings can be rented that will serve fairly well as hatchery buildings, but the best arrangement is a building planned and constructed especially to serve as a hatchery building.

Plans for a Hatchery Building

Before building, careful consideration should be given to the services performed in a hatchery, and plans should be developed whereby the arrangement of the building will save time and labor in performing the work that has to be done. Figure 3–2 shows a suggested floor plan

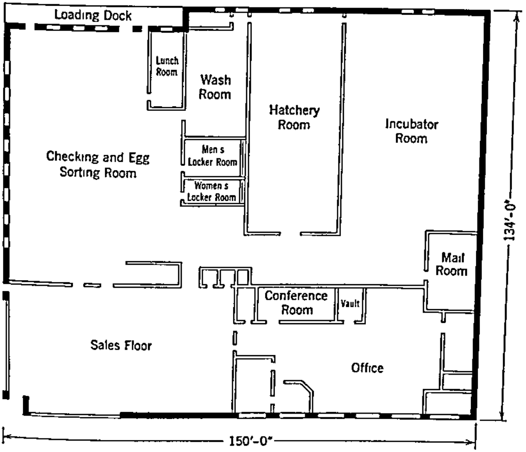


FIG 3–2. Floor plan of well-arranged, large commercial hatchery. (From *Hatchery & Feed*, September 1952.)

for a well-arranged hatchery. The arrangement of a hatchery building will depend somewhat upon its capacity and the side lines carried by the hatchery. Any hatchery worthy of the name should have separate rooms for the office and the incubators. Other separate rooms such as

a room for cleaning trays, an egg-holding room, egg-receiving and traying room, and display room for equipment are desirable.

Construction

It is desirable that the hatchery building be well constructed of durable and fireproof material, insulated, properly ventilated, heated and lighted, and, in the warmer regions, air-conditioned.

Different materials have been used for constructing satisfactory hatchery buildings. Hollow tile, stuccoed over the outside with glazed

FIG 3-3. The interior of a well-constructed hatchery building. Note concrete floor with drains, glazed tile walls, space heaters, high ceilings, and adequate lighting (Courtesy Western Hatcheries, Dallas, Texas)

tile inside, makes a very attractive and serviceable building Brick on the outside and glazed tile on the inside make for durability and for ease in cleaning (See Fig 3-3.)

It is highly desirable that the temperature of a hatchery be fairly uniform throughout the year. Therefore it is important that the building be insulated to minimize the extremes in temperature and thereby reduce the cost of heating and cooling.

Air conditioning of offices, chick-holding rooms, and egg-traying rooms is almost a must for hatcheries that attempt to operate the year

around in the Midwest and South It not only protects the chicks, but air conditioning also increases the efficiency of the labor used in the hatchery and in the office

A dependable and economical heating system, which will maintain uniform temperature throughout the cold months, is necessary Hot water and steam systems with radiators or space heaters are very satisfactory

Proper lighting is necessary for efficient work in performing the services required in a hatchery Fluorescent lighting has become popular in hatcheries

Sufficient ventilation is required to remove moisture, odors, and carbon dioxide and to provide plenty of fresh air for the employees and the incubators

A well constructed hatchery building should be fireproof, but since most incubators in use are made of wood and therefore will burn readily, fire extinguishers should be installed in the hatchery building especially in the incubator room, and other rooms where there are supplies or equipment that may be ignited

INCUBATORS

The most important equipment in a hatchery are the incubators The success of a hatchery frequently depends upon the cost of producing chicks, and the cost is determined largely by the percentage of hatch obtained and labor efficiency in producing chicks The selection of the proper incubator may determine the success or failure of a hatchery Fortunately incubators have been greatly improved since the 1920s and the hatcheryman may now choose any of several well constructed incubators that hatch high quality chicks (See Fig 3–4)

Types of Incubators

All present day incubators purchased by hatcherymen are of the forced draft type The hatcheryman, however, must choose between incubators that incubate and hatch within the same compartment and those that incubate in one compartment and hatch in another compartment or machine They must also choose between incubators where eggs of all ages are incubated together and single stage (same age eggs) incubators Each of these types of incubators has its adherents and apparently all of them are giving satisfactory results

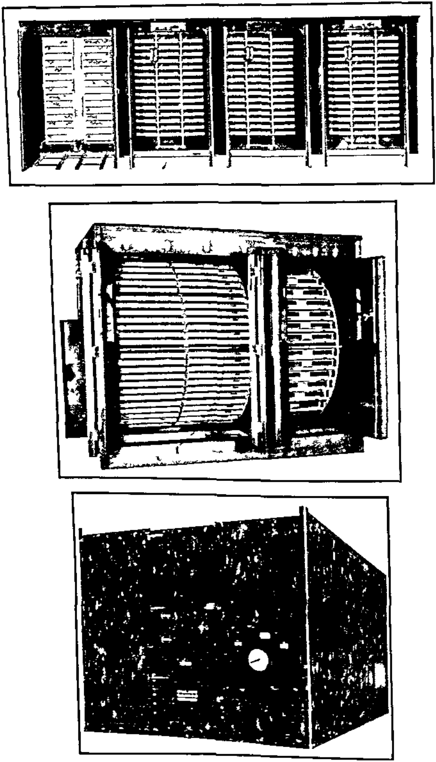
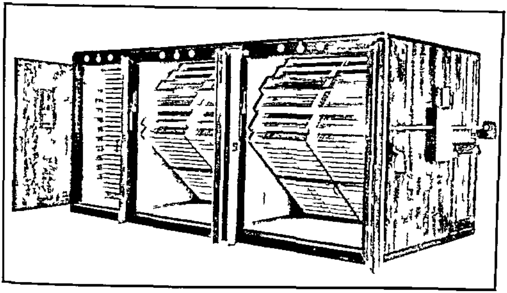
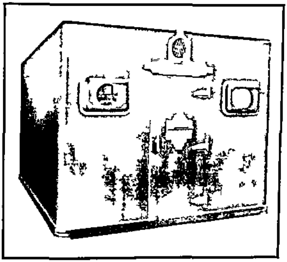


Fig 3–4 Modern incubators (Courtesy following incubator companies Bundy Petersime Chick Master Robbins Buckeye and Jamesway)





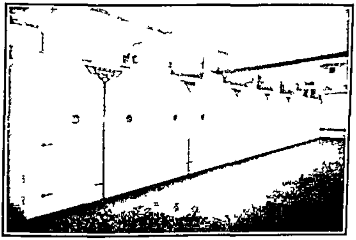


FIG. 3–4 *Continued*

Construction

An incubator must be well insulated so as to maintain uniform temperature throughout, and it should be built to require a minimum of maintenance and repairs over a period of years. Wood, plywood, and metal are used for the exterior as well as for the interior wall. Some are finished with inlaid linoleum inside and outside. Cork and Fiberglas are used for insulation.

Cost

The original cost of an incubator must be considered, but the cost of operation per chick hatched and the labor cost of producing chicks with the incubator are more important than the original cost. Many hatcherymen who have been slow to abandon obsolete equipment could pay for new equipment within a few seasons out of what they realize from the extra salable chicks that modern incubators would produce for them. On the other hand there is no need to abandon old incubators that hatch well and do so efficiently.

Controls

An incubator, to be successful, must be equipped with controls which accurately control temperature, humidity, and turning and it must be built to provide fresh air and remove carbon dioxide. Incubators come equipped with accurate thermometers, but the accuracy should be checked from time to time. The wicks used on wet bulb thermometers must be kept free of mineral deposit from hard water. Soft water should be used with such thermometers. The turning mechanism should be checked regularly to see that it is operating properly.

Other Considerations

The hatcheryman when selecting an incubator, should consider the floor space required and the height of the machine. He should also consider ease of cleaning and disinfecting for sanitation. The amount of labor required to produce 100 chicks is an important consideration and will become more important in the future.

OFFICE EQUIPMENT

The business operations of a hatchery, which must be accurate, are performed in the offices. Therefore, well-equipped and properly arranged offices are needed for carrying on the business of the hatchery

Desks, filing cabinets, typewriters, record books, adding machines, and a safe are required in every well-managed hatchery.

A mimeographing machine or other duplicator is a useful piece of equipment for most hatcheries. An addressograph is valuable where large mailing lists are circularized. For a detailed discussion of hatchery office work, see Chapter 14.

OTHER EQUIPMENT

The equipment needed for servicing hatchery supply flocks is described in Chapter 4.

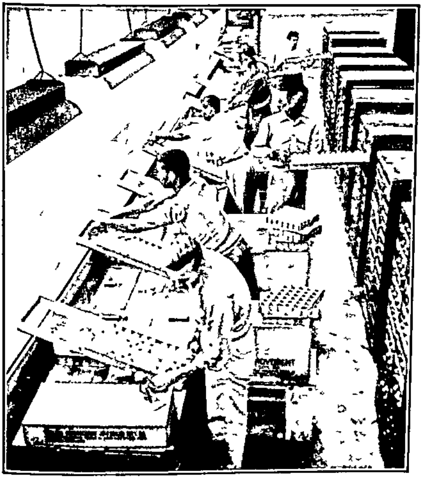


FIG. 3-5. Egg traying in a large, modern hatchery. Note the tray carts back of the trayers, which hold the empty and filled trays until they are moved into the incubator room (Courtesy Western Hatcheries, Dallas, Texas)

For handling the hatching eggs an adequate supply of egg cases will be needed. Fiberboard or corrugated fiberboard cases are gaining in popularity for handling hatching eggs. Egg scales are necessary for

FIG. 3-6. Setting up chick boxes Left, motor-driven stapler, and right, hand stapler (Courtesy W. B Smith Hatchery, Columbia, Missouri.)

FIG. 3-7. Sorting chicks on a moving belt grading table at Western Cooperative Hatcheries, Bellevue, Washington.

those who tray hatching eggs, so they may check any eggs whose size is in question Some hatcheries and hatching egg dealers use egg grading or weighing machines Benches and tables are needed for traying eggs, as well as racks for holding the egg trays before they are transferred to the incubators (See Fig 3–5)

Some equipment is required for handling the chicks in the hatchery Chick boxes (25 , 50 , and 100 chick capacity) must be assembled and punched These boxes are purchased knocked down and must be assembled at the hatchery Figure 3–6 shows chick boxes being assem bled and punched

Special conveyors for removing the chicks from the incubators have been developed See Figs 11–3 and 13–16*a*, *b*, *c*, and *d*

It is necessary to carefully cull or grade all chicks and accurately count them into the chick boxes Figure 3–7 shows a specially de- signed sorting table being used for grading chicks After the chicks are boxed, if held for any length of time, it is desirable to have racks for holding the boxes where they will be separated sufficiently to insure adequate ventilation

The boxes may be tied with twine or with wire A wire tieing de vice may be rented for that purpose Hatcheries that do a sizable mail order business use postage meters, which may be leased from the manufacturers and set by the local post office for the amount of postage purchased Paper tape on which the postage is recorded is substituted for stamps

The use of delivery trucks, vans, etc , for transporting chicks is discussed in Chapter 14

Some equipment is required for keeping the hatchery and its equip ment in a sanitary condition A vacuum cleaner is a must for remov ing chick down, etc , from the incubator or hatchers Proper cleaning of incubator trays is sometimes neglected, but to do so is to court serious chick troubles such as mushy chick disease The hatching trays must be thoroughly cleaned and disinfected after each use Motor driven wire brushes are helpful in removing most of the adhering dirt Tray washing machines have been developed for cleaning hatching trays (See Fig 13–13) Some hatcheries use steam hot water, or disinfectants to sterilize these trays

4

Flock Selection and Pullorum Testing

The success or failure of a commercial hatchery may depend upon the kind of field program followed in doing flock selection and testing for pullorum disease

HATCHERY FLOCK OWNER RELATIONSHIPS

It is most important that the flock owners who supply the hatching eggs be enthusiastic supporters of the hatchery and its program To gain and retain such support the hatcheryman and his employees must make friends of the flock owners and help them maintain profitable flocks

The hatchery should select flock owners carefully, taking only the best producers available They should be farmers or poultrymen who have or can provide suitable houses and equipment Such flock owners must be cooperative and willing to follow the hatchery's program, which should be explained and understood by the flock owner before an agreement is entered

Hatchery flock owner relationships should be considered by both parties as a cooperative endeavor, *and each should understand* how important the success of the other party is to his success

The hatchery can be of service to flock owners by advising them in feeding and managing their flocks and especially in the production and care of hatching eggs Frequent visits to the farms will also help maintain friendly relations and show that the hatcheryman has the flock owner's interests at heart

It goes without saying that whoever represents the hatchery on these visits must be able to give sound and helpful advice to the flock owner in order to keep his confidence in the hatchery

TRAINING FLOCK SELECTING AND PULLORUM TESTING AGENTS

Most states provide some short course training for hatchery owners or persons employed by hatcheries who do flock work In many states these short courses have developed into schools jointly sponsored by the state college of agriculture and the poultry improvement association

The following subject matter is suggested for a training school

1 A discussion of breeds and varieties of poultry
2 Selecting young stock for breeding flocks
3 Selecting old stock for breeding flocks
4 Improving poultry by selection
5 Culling and selecting birds for purebred flock replacements
6 Selecting breeding flocks for broiler chick production
7 Individual selection as compared to other systems of selecting breeding stock
8 Pullorum disease and its control
9 A discussion of the control of other poultry diseases
10 Demonstration of rapid whole bloodtesting of poultry for pullorum disease
11 Demonstration of drawing blood samples for tube testing
12 Practice by students in testing for pullorum disease
13 Demonstration by students of ability to bloodtest for pullorum disease
14 Practical examination in selecting poultry breeding stock
15 Written examination on flock work etc

PRELIMINARY TRAINING AND STUDY DESIRABLE

If the hatchery will give its employees some training and experience in flock work before they attend one of these short courses they will get much more out of such schools

Many schools provide study material and review questions for those who preregister for such instruction (see Fig 4–1) Students who obtain such material are much better prepared for the school and learn more in the limited time available for the short course than those who have not prepared

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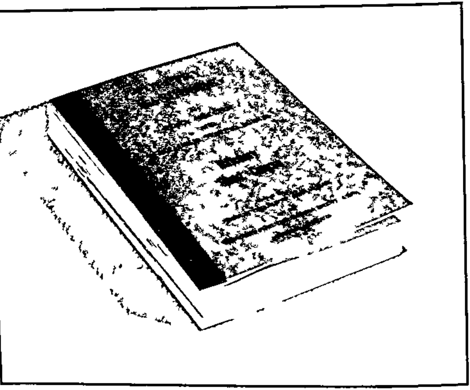


FIG 4–1 Poultry handbook for training flock selecting and testing agents (Courtesy Missouri College of Agriculture)

FIELD EXPERIENCE AFTER SCHOOL

In a supervised flock improvement program which utilizes general farm flocks as a source of hatching eggs it is highly desirable that an inspector from the poultry improvement agency of the state spend some time with new agents as they begin work in the field If this is not feasible the hatcheryman or an experienced agent should do so It is also good practice to fit newly trained personnel into crews with agents who have had experience One of the weak links in poultry improvement work is the necessity for training large numbers of new agents annually in the United States to meet the demand caused by employee turnover in the highly seasonal hatchery business Hatcheries need to develop a program to attract and keep more permanent employees for this work

AUTHORIZATION TO DO FLOCK WORK

Those who pass the examinations given at the hatchery training school, and are designated as selecting and/or testing agents by a participating hatchery, are authorized by the official state agency to do flock work See (certificate) Fig 4–2

Missouri Poultry Improvement Association

Flock Selecting and Pullorum Testing Agent's Certificate

This is to certify that

employed by

has completed the requirements for flock selecting and pullorum testing and is hereby authorized to do flock selection and pullorum testing for those who are operating under the supervision of the Missouri Poultry Improvement Association Failure to comply with the rules and regulations of the official State agency and the flock selecting agent's agreement will cause this certificate to be revoked and withdrawn

MISSOURI POULTRY IMPROVEMENT COMMITTEE
(Official State Agency)

Date Issued Secretary

This Certificate Expires August 1, 19

Fig 4–2 Certificate of authorization for flock selecting and testing agents (Courtesy Missouri Poultry Improvement Association)

FLOCK-SELECTING AND TESTING AGENTS' AGREEMENT

The official state agency that administers a poultry improvement program may find it desirable to require an agreement between the agent and the agency An example of such an agreement is reproduced herewith

MISSOURI POULTRY IMPROVEMENT ASSOCIATION

FLOCK SELECTING AND PULLORUM TESTING AGENT'S AGREEMENT

In Consideration of the fact that I have been authorized by the M P I Committee (Official State agency) of Missouri to cull and blood test poultry flocks in Missouri, I hereby agree that

1 I will cull and blood test flocks as instructed at the Annual Hatchery Short Course Before beginning flock work on each farm I will see that *all birds* on the farm are confined where I can handle them.

2. I will use blood testing equipment of a type approved by a representative of the M P I Association.

3 I will band only birds which meet at least the minimum requirements of the breeding stage under which the hatchery is operating. Where possible I will remove or encourage the removal of all culls and reactors the day the flock is culled and blood tested. I will clip the tails of all culls and reactors and remove the leg bands from such birds.

4 I agree to make complete flock reports as required by the M P I A each time the flock is selected, banded or blood tested.

5 I will explain to each flock owner the rules and regulations which pertain to their participation.

6. A. As the owner or manager of the hatchery I agree to send to the Secretary of the Missouri Poultry Improvement Association, Columbia, Missouri copies of the flock selecting reports at least once each week while I am doing flock work.

B As an employee of a hatcheryman I agree to see that the flock reports are sent to the above agency each week.

7 It is understood that my work will be checked and if the official State Inspector finds that my work has not been satisfactory in accordance with this agreement and the regulations of the MPI Committee, I hereby agree to the revocation of my certificate and its immediate surrender to the official State Inspector

8. I agree to file (or see that the hatchery office files) the hatchery copies of all my flock reports, arranging them alphabetically

Approved ______________________ Signed ______________________
(Sec'y Official State Agency) (Flock Selecting Agent)

Date ______________________ Hatchery ______________________

Address ______________________

Date ______________________

FIELD WORK

Flock work in the field consists of two operations. selection of breeding stock and testing that stock for pullorum and typhoid disease. Before discussing the detailed flock selection work we may consider the broader aspects of the problem Dr W. F Krueger, speaking at the

1953 Hatchery Short Course at the University of Missouri, presented the following.

Individual Selection Compared with Other Systems of Selecting Breeding Stock

What birds would you select for your breeding flock? Look over the families and make your choice.

For Egg Production

	Family A	Family B
	250 eggs	300 eggs
	200 "	230
	190 "	90 "
	170 "	100
	170 "	120 "
Average	196 eggs	168 eggs

For Body Weight at Ten Weeks of Age

	Family 1	Family 2
	3.5 lb	3.9 lb
	3.1	2.8 "
	3.0 "	3.5 "
	3.2 "	1.9 "
	2.9 "	2.4 "
Average	3.1 lb	2.9 lb

Now let us see what factors should be considered in making a wise choice of breeders.

The major objective in any poultry improvement program is to make selection as effective as possible. From a breeding or genetic point of view, this requires changing *gene frequency*. All traits are affected by hereditary units called genes which are located in the cells of the bird. Some of these genes make for good performance and some for poor performance, and in every population, no matter how good, both kinds of genes exist. If selection is to be effective, the breeder must increase the proportion or frequency of desirable genes.

This brings up the next question, how can one change gene frequency or increase the proportion of favorable hereditary units? The application of selection pressure is the breeder's main tool for changing gene frequency. Let's use an example to demonstrate what we mean by selection pressure. Let us assume that the average production of the birds selected for breeders is 220 eggs and the average production of the population or flock from which these breeders come is 180 eggs. The amount of selection pressure one would be applying for egg production alone would be 40 eggs. The same procedure would apply for traits other than production. It stands to reason that the greater the selection pressure or differential the more likely we are to make progress through breeding.

Effectiveness of selection also depends on the heritability of the traits being considered Certain traits such as body weight, egg weight, feather development, and fleshing are rather highly heritable and thus respond well to selection Other economic characters such as egg production, mortality, hatchability, and possibly fertility have low heritability and may not respond too well to selection In the latter case, a large number of genes influence these traits, many of which may be highly affected by environmental conditions such as care, housing, etc

The amount of progress one can expect per year also is a function of the *generation interval* *Certain systems of breeding require more time to produce a generation*, thus possibly reducing the amount of progress per year This should not be overlooked

With that background, what are some methods of selection and where is each the most efficient?

1 *Individual or Mass Selection* This is the simplest form of selection and utilizes the bird's own performance as the criterion of selection It is the only form of selection that most hatcherymen are in a position to employ, and unfortunately mass selection is the only type of selection used by many breeders Rate of improvement per generation is a direct function of heritability The amount of progress one can expect per generation from individual selection is equal to the selection differential (selection pressure) times the heritability Assuming a selection differential of 40 eggs for egg production and heritability of 5 per cent, the amount of improvement expected per generation would be two eggs Superimpose on this type of selection errors due to strong environmental influence (environmental advantages that make certain birds' records look good) and progress per generation may become nil even with a selection differential of 40 eggs What we have done is to choose birds as breeders that are superior because of *favorable environmental conditions rather than those superior in genetic* background Individual selection can be effective for highly heritable traits such as body weights, carcass measurements egg size, feathering and color patterns

2 *Pedigree Selection* Pedigree selection makes use of the ancestors of the animals to be chosen as breeders In its simplest form—breeders are selected on the basis of sire and dam performance Pedigree information can be of value in selection but using it as the sole means of choosing the best breeding birds is rather inefficient The main disadvantage of this system is that environment (feed, range, disease hazards, etc) of the parent stock may be quite different from that of the offspring thus confusing genetic advantage with environmental advantage

3 *Family Selections* Family selection involves the use of the family *average* *One of its main advantages is that it tends to rule or average out* environmental effects which may affect one individual differently than another For traits with low heritability such as egg production, hatchability and mortality, selection based on the family average is more efficient than individual or pedigree selection.

4 *Progeny Test Selection* Under this system, selection of sires and dams for reproduction of the population is based on progeny performance This is the most accurate estimate of breeding worth provided enough daughters

are produced to properly evaluate sires and dams The major disadvantage of this system is that more time is required to produce a generation, and thus the amount of progress per year may be less than that from family selection Dr Lerner of the University of California has suggested the use of a combination of family selection and progeny testing in which a high percentage (75 per cent or more) of pullet and cockerel breeders are used and are selected on part-year family and individual records to January 1

5 *Combination Selection* Combination selection combines individual and family selection giving each its proper weight The formula would be as follows

$$\text{Selection coefficient} = I + WA$$

where I is the individual's performance, A the family average, and W the weight given the family average Dr Lerner estimates the weighting for egg production (hen housed) to be about 4 for families of 5 sisters Applying this weighting to the two family records presented earlier, the results would be as follows

Family A	Family B
$250 + 4(196) = 1034$	$300 + 4(168) = 972$
$200 + 4(196) = 984$	$230 + 4(168) = 902$

If this weighting is correct, the two high producing birds in Family A are more desirable breeders than those in Family B

Where does your program as a breeder or hatcheryman fit into this scheme? What system of selection are you able to practice? The hatcheryman can practice individual selection and then only on a limited scale He must depend on the breeder who is in a position to use the more effective methods of selection The chicken or turkey breeder who uses the above tools to the greatest advantage will not need to worry about disposing of his eggs, chicks, or poults Hatcherymen and commercial poultrymen will be waiting!

SELECTING FOR EGG PRODUCTION

Those familiar with culling know that birds cannot be selected accurately for egg production by physical appearance However, on the average, one who has had experience in culling can do the flock owner much good and improve the quality of the breeding stock by careful selection or culling Since very few birds are now kept over into a second breeding year, most culling is on pullets which is more difficult than selecting birds at the end of a laying year

The important considerations in selecting pullets are vigor and health, maturity and freedom from physical deformities Birds lacking vitality, as evidenced by being thin, pale about the head, or with sunken eyes, should be sent to market Any evidence of disease such

as "fishy" eyes or other evidence of paralysis should be cause for leaving a bird out of the laying or breeding flock Late maturing birds in a flock should be sent to market Birds having deformed beaks, backs, legs, or other serious deformities should be rejected for the breeding flock

Hens can be culled more accurately than pullets because they undergo certain physiological changes while laying which can be used to judge persistency and intensity of laying When a yellow skinned pullet begins to lay, the yellow pigment from the feed is diverted from the skin and body fat to the yolk of the egg and as a result the skin begins to bleach out The order and time of bleaching is vent, 0–7 days, eye ring 7–10 days, earlobes (white) 10–14 days, beak, 4–6 weeks and shanks, 4–8 months Smaller birds tend to bleach more rapidly than larger birds Some vacations or pauses can also be detected by studying the pigment changes When a chicken stops egg production the yellow pigment returns in the order it bleached out but at a rate approximately twice as fast as it disappeared

Molt also gives an indication of egg production The better producers tend to molt late and to molt rapidly The early and slow molting birds are almost invariably poor producers Molt is judged principally by the molting of the primary wing feathers The better producers drop and grow in several feathers at one time The experienced person can also detect vacation periods by the molt, most layers start to molt when they stop laying and later this shows in the new feathers among the old primary feathers

Handling quality is also indicative of intensity of production Layers that have soft pliable skin and abdomens are generally birds that lay at a high rate of production

SELECTING BREEDING STOCK FOR MEAT PRODUCTION

The development of the broiler industry has created a demand for breeding flocks to produce hatching eggs of the broiler or meat strains of chickens Such flocks are selected primarily for meat qualities

Select a Broiler Strain

It is important that those who produce broiler chicks have the broiler or meat strains and crosses The broiler growers know the chicken they want The hatcherymen have the problem of keeping abreast of this demand and finding any developing trends towards strains, crosses etc.

Demand for First-Generation Stock

There has been a growing demand for first-generation breeding stock, a demand which the breeders have quite naturally encouraged. It is questionable whether it is necessary for a hatcheryman to go back every year to a breeder for all his purebred replacement stock. There is still a place in a commercial hatchery program for key flocks in both meat and egg production. Such flocks should be carefully selected, and eggs from such flocks should be used in producing chicks for the regular hatchery supply flocks.

Selection at Day-Old and 8–14 Days of Age

Baby chicks when day-old may be selected for rapid feathering by observing the primary and secondary wing feathers These feathers

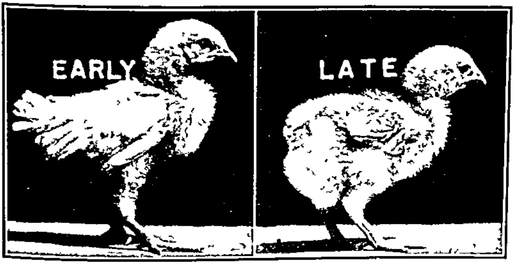


FIG 4–3 Chicks showing early and late feathering at 8–14 days of age. (Courtesy Kansas State College)

in rapid feathering individuals extend well beyond the down. The primaries are also much longer than their coverts. These differences are more apparent at day-old than 2 or 3 days later.

Early feathering chicks show well-developed tail and wing feathers at 8 to 14 days of age. Their wing feathers will extend to the rear of the body whereas late or slow feathering chicks will have wing feathers extending only half or two-thirds the length of the body. (See Fig. 4–3.)

Selection at Broiler Size

The best time to select breeding stock for broiler production is when the stock is at that age or size The characters to be considered can be judged more accurately at that time than earlier or later.

The kind of feathering, especially back and body feathering including freedom from pin feathers at that stage, can be determined then Fleshing and finish as well as size can be judged more accurately

It is important in breeding for meat production (broilers) that both the males and females be selected when they are at the age or size their mates are to be marketed

Adult Selection

It is too late to do a good job of selecting breeding stock for broiler production if this selection is delayed until the birds are mature There are, however, some things to consider when selecting the adult stock All birds showing deformities or evidence of disease should be discarded Only the vigorous and healthy individuals should be retained as breeders

STANDARD QUALITIES

Emphasis has been shifting from standard bred qualities to the more economic characters Such a shift can be more easily justified in broiler strains than in strains kept for egg production because the progeny of broiler stocks is going to be marketed at 9 to 12 weeks of age However, all purebred breeding stock should be kept reasonably close to their standards by selecting for the important variety determining characteristics This should be particularly true of the key or foundation flocks

TESTING FOR PULLORUM DISEASE

A major part of any flock work is the control of pullorum disease The use of chicks from clean stock for flock replacements is necessary in controlling this disease But in addition to using such chicks an accurate testing program must be followed There are three recognized tests for this disease the Standard Tube Agglutination Test, the Stained Antigen, Rapid, Whole Blood Test, and the Rapid Serum Test Most testing of chickens is done with the Stained Antigen, Rapid, Whole Blood Test, the Tube Test is used principally in testing turkeys

Standard Tube Agglutination Test

This is a laboratory test, with the blood being drawn in the field and then taken or shipped to a recognized or official laboratory where the tests are made

Drawing Blood Two instruments are used in drawing blood, a knife or a syringe A knife is more common for drawing blood from chickens

and the syringe more for turkeys The following instructions for drawing blood for tube testing are from the Department of Veterinary Bacteriology, University of Missouri Veterinary School

Collecting Blood Samples from Poultry for the Tube Test

A Using a knife

1 Number the tube, with the first number nearest the open end of the tube
2 Puncture the wing vein lengthwise
3 Collect blood holding the tube with the *numbered* side up
4 Stopper tube, wipe off excess blood or feathers
5 Place tube *flat* in a shallow box A 5 pound cheese box made of light wood is excellent
6 *a* Low temperatures lengthen the clotting time
   b High temperatures shorten the clotting time
   c Shaking the samples or allowing them to roll in the box is very undesirable as often the *serum clots* and the sample cannot be tested
   d Be sure the number on tube corresponds with the band on the bird
7 When the box is ¾ full of samples, carefully and without shaking
   a At low temperatures place them where it is warm and allow the blood to clot along the side of the tube before they are placed in the refrigerator, *if* they are to be shipped
   b At high temperatures place them in a cool area such as a portable icebox and allow the blood to clot along the side of the tube, before they are placed in the refrigerator, *if* they are to be shipped
8 Do not allow the samples to *freeze*, or *spoil* by getting too hot In either case the birds will have to be rebled
9 Pack the samples carefully in the small tins then pack the tins in ice and sawdust in the 50 lb lard can
10 *Note* Taking *good* samples is your responsibility
11 In past years we have found several items which are very undesirable
   a Holding tubes weeks after the normal date of return (Other folks wish to use the tubes)
   b Improperly packing samples resulting in spoilage or freezing
   c So much blood on the outside of the tubes that they stick together and such an excess of feathers that they appear to be used for packing
   d Standing the tubes upright before they are properly clotted
   e Shaking or rolling the tubes (The serum clots, it does not separate)
   f Pushing corks in too tight on warm days (Push them in just tightly enough to prevent leaking when they are on their sides in the cheese box)
   g Enclose a *copy* of the *MPIA record* with samples from each flock

B Using a syringe follow the same procedure after the blood is drawn

C Miscellaneous

1 Collect blood in the tube until it reaches the bottom of the frosted area
2 Poultry blood *spoils rapidly*
3 Expect spoilage in improperly packed samples, as express cars are heated
4 *Do not bleed sick flocks*
5 Keep equipment and clothing clean as disesaes may be carried from one flock to another
6 Avoid foamy blood samples and blood beneath the numbered area of tubes

Stained Antigen, Rapid, Whole Blood Test

This is a practical field test for pullorum disease which has been generally adopted by the commercial hatchery industry In trained hands this test has proved as efficient as the tube test for detecting reactors It has the advantage of detecting reactors while the birds are being handled, so that any reactors found can be removed then, without rehandling the flock It also avoids the problem of mistakes in numbering vials typing lists of reactors, etc The following description of this test is from the National Poultry Improvement Plan, with slight modifications found to be improvements in actual field practice

The Loop Method The loop method is carried out as follows At the end of a 2⅙-inch length of non-corrosive wire (Brown and Sharpe gage No 24) a loop 3⁄16 inch in diameter is made For convenience the wire is inserted into a small cork stopper which serves as a handle It has been found that the blood can be *measured rapidly and with sufficient accuracy* by use of the wire loop Such a loop when filled with blood so that the blood appears to bulge out delivers 0 02 cc The antigen is measured by means of a medicine dropper whose tip is adjusted to deliver 0 05 cc when operated in the vertical position By this means the proportion of antigen to blood is kept between the limits of 2 to 1 and 3 to 1, *which has* been found to give the most satisfactory results A drop of stained antigen is placed on a white porcelain or vitreolite glass plate 11⁄32 inch thick A loopful of blood is taken up from the wing vein When submerged in the blood and then carefully withdrawn the loop comes away properly filled On looking down edgewise at the filled loop one observes that the blood appears to bulge out The loopful of blood is then stirred into the drop of antigen and the mixture spread to a diameter of a quarter or about ¾ inch The loop is then rinsed in clean water and dried by touching it to a piece of clean blotting paper if necessary The test plate is rocked from side to side a few times to mix the antigen and blood thoroughly and to facilitate agglutination The antigen should be used according to the directions of the producer Various degrees of reaction are observed in this as in other aggluti

nation tests. The greater the agglutinating power of the blood the more rapid the clumping and the larger the clumps. A positive reaction consists of a clumping of the antigen in well-developed flocculi surrounded by spaces only partially clear. The interpretation of these partial reactions should be the same as that of similar incomplete "tube method" agglutination reactions. Between this point and a negative or homogeneous smear there sometimes occurs a very fine granulation barely visible to the naked eye; this should be disregarded in making a diagnosis.

The very fine marginal flocculation which may occur just before drying up is also regarded as negative. In a non-reactor the smear

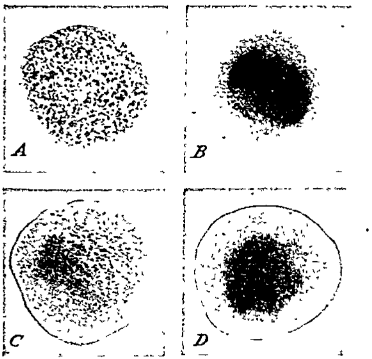


FIG. 4–4. Rapid test for pullorum disease. *A*, strong reaction when plate is rotated; *B*, same blood as used in *A*, but plate was not rocked; *C*, blood showing weak reaction when plate was rocked showed no reaction (*D*) when plate was not rocked. (Courtesy Agricultural Research Service, U.S.D.A.)

remains homogeneous. A plate about 15 inches square providing space for 48 tests has proved satisfactory for this work. The plate enables the tester to have a number of successive test mixtures under observation without holding up the work to wait for results before proceeding to the next bird. Figure 4–4 shows a positive reaction and a negative test as observed in making the rapid test.

Equipment Needed for Field Testing

A truck or car will be needed to haul the testing equipment, coops, and birds removed from the flock. Catching coops or hurdles for catch-

ing the birds will be needed Bottomless coops made of heavy wire are more sanitary than coops having bottoms Hurdles as shown in Fig 4-5 are easily handled and are very convenient in check testing work

FIG. 4-5 Wire hurdles are convenient for handling birds in the house (Courtesy Mo Agr Exp Sta)

Flocks Should Be Handled Properly

The field crew drawing blood or making the rapid test should be as clean and sanitary as possible especially in moving from farm to farm in order to prevent carrying disease from one flock to another Some practical suggestions in this respect are clean and spray, with a reliable disinfectant all equipment moved from flock to flock use rubbers or shoes which can be disinfected use rubber aprons which can be disinfected or change outer garments

It is important that the production of the flock be disturbed as little as possible Therefore every effort should be made to handle the

Missouri Poultry Improvement Association

FLOCK PROBATION REPORT

(For use by Flock Selecting Agents)

HATCHERY COPY
(To be attached to Hatcheryman's copy of N P I P Form 3 or flock report.)

Flock Owner Address

Breed Date

This flock is not ready to sell hatching eggs because (Number) birds which were not approved were left on the premises.

(Flock Selecting Agent)

OFFICIAL STATE AGENCY COPY

Flock Owner Address

Breed Date

This is to certify that the culls which were left on the premises of this flock owner on (date) have been disposed of in a satisfactory manner

(Name of Hatchery) (Flock Selecting Agent or Hatcheryman)

(To be mailed to the official State agency AFTER the flock owner reports the culls sold or otherwise disposed of)

FLOCK OWNER COPY
(To be attached to Hatcheryman's copy of N P I P Form 3 or flock report.)

I certify that all birds not approved have been disposed of as follows

Number sold (Attach sales receipt)

Other disposal (Method) (Number)

It is understood that my flock is now eligible to supply hatching eggs.

Date (Flock Owner)

(The flock owner should return this report to the hatcheryman when all birds not approved have been disposed of)

FIG 4-6 Flock probation report to be used when culls are left on the premises (Courtesy Missouri Poultry Improvement Association)

flock carefully and with as little disturbance as possible The flock owner should be present to help catch and handle the birds They appreciate care in handling their flock

The testing cabinet is important It should have some arrangement for heating such as an alcohol lamp or an electrical device for keeping the plate warm in cool weather when most flock work is done The cabinet should be constructed so that the plate can be rocked in the cabinet, or removable so that it can be picked up and the blood and antigen thoroughly mixed by rotating the plate The plate should be white so that reactions can be easily seen

Removal of Culls and Reactors

It is desirable that all culls and reactors be removed from the flock and sent to market when the flock work is completed The best way to do this is for the testing crew to carry sufficient coops to hold all culls and reactors removed in a day's work If this is not feasible, arrangements should be made for a produce house to pick up such birds soon after the flock work is completed

If culls and reactors are left on the premises the flock should be placed on probation (see Fig 4–6) and no hatching eggs purchased from the flock until the conditions causing it to be placed on probation have been corrected

PROGRESS IN PULLORUM CONTROL

Marked progress has been made since the advent of the National Poultry Improvement Plan in the control of pullorum disease This is evidenced by the reduction in reactors found on first tests (See Fig 4–7)

Several states have collected records on the livability of several million chicks (See Table 4–1) These studies show that producers now lose less than 3 per cent of the chicks purchased from United States pullorum passed or clean hatcheries The Missouri data for a 12 year period is typical of the livability that producers are having with chicks produced under a well organized poultry improvement program

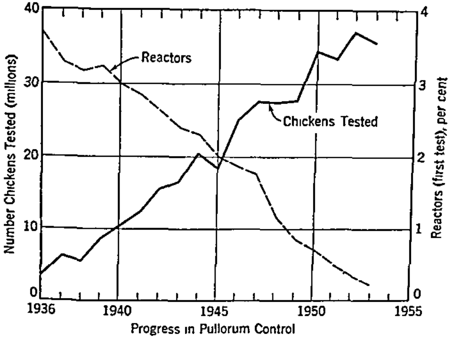


FIG 4-7. *Progress made in controlling pullorum disease under the National Poultry Improvement Plan* (Courtesy U S D A Bureau of Animal Industry)

Table 4-1 *Livability of chicks produced under the pullorum classes of the National Poultry Improvement Plan in Missouri, 1942 1953*

Year	Total Number of Chicks Purchased by Those Reporting	Percentage of Chicks Reported Alive at the End of 3 Weeks by Purchasers
1942	241,723	96.2
1943	275,557	96 7
1944	422,185	96.4
1945	706,733	95.8
1946	498,697	96 5
1947	531,116	97.3
1948	575,652	97.5
1949	600,168	98.0
1950	805,782	98 1
1951	593,377	98.4
1952	348,553	98.5
1953	390,486	98.4

5

Poultry Improvement

The improvement made with poultry in the United States since the start of the century has been truly remarkable. Much of this progress was made by individual breeders working alone. But more rapid progress has been made since these breeders joined together in clubs, associations, improvement boards, and the National Poultry Improvement Plan with the objective of improving poultry.

The American Poultry Association, through its shows and Standard of Perfection, did much to improve the type and color markings of standard bred poultry.

As poultry became more important in our agricultural economy, emphasis shifted to the economic qualities of our domestic poultry and trapnest records replaced the showroom award as the measure of a bird's worth.

Poultry breeders banded themselves together in state and national organizations and worked for the development of poultry departments within the state colleges of agriculture and for the establishment of egg laying contests. Many state associations of poultry breeders and hatcherymen developed independent poultry improvement programs of their own which were designed to assist the members in their poultry improvement work. Such programs were uncoordinated and therefore lacked uniformity of standards and terminology. As the hatchery industry developed and chicks were widely distributed into many states by a single hatchery the confusion in terminology became apparent and the demand arose for a national uniform program for poultry improvement.

THE MANHATTAN, KANSAS, CONFERENCE

The demand for a uniform program became so strong that the industry held a meeting in 1925 at Manhattan, Kansas, of all interested organizations to consider the development of a uniform plan for poultry

Table 5-1 A comparison of 7 of the more seriously considered plans for national standardization and accreditation

Authority for Plan*		1st Grade	2nd Grade	3rd Grade	Disease Eradication to Be Added to the Breed Term in Each Grade If Requirements Are Met	Breed Improvement and Disease Eradication Combined
1 Manhattan	Contest R O P.	Home R O P	Certified	Accredited	B W D Accredited	Contest R O P—B W D Accredited Home R O P—B W D Accredited Certified —B W D. Accredited B W D Accredited
2 Northeastern	Contest R O P or Advanced Registry	Home R O P	Certified	Supervised	B W D Accredited	Contest R O P—B W D Accredited Home R O P—B W D Accredited Certified —B W D Accredited Supervised —B W D Accredited
3 International Baby Chick Association	Contest R O P.	Home R O P	Certified	Standard Accredited	B W D Accredited	Contest R O P—B W D Accredited Home R O P—B W D Accredited Certified —B W D Accredited Standard —B W D Accredited
4 U S Bureau Animal Industry 1st Chicago		U S R O P.	U S Bi-Certified	U S Certified	B W D Tested for 1st test B W D Accredited (Free)	U S R O P B W D Accredited or Tested U S Bi Certified B W D Accredited or Tested U S Certified B W D Accredited or Tested
5 U S Bureau Animal Industry 2nd Chicago		U S R O P	U S Bi-Certified	U S Certified	B W D Tested	U S R O P B W D Tested U S Bi Certified B W D Tested U S Certified B W D Tested
6 Latest U S Bureau Animal Industry proposal		U S R O P Accredited	U S Certified Accredited	U S Standard Accredited	B W D Accredited	U S R O P B W D Accredited U S Certified B W D Accredited U S Standard B W D Accredited
7 A proposal by many states		U S R O P	U S Certified	U S Standard †	U S B W D Tested (1st test) U S B W D Accredited (Free)	U S R O P B W D Accredited U S Certified B W D Accredited U S Standard B W D Accredited

* Plan 1 Approved by Poultry Instructors' Association and International Baby Chick Association and adopted by most of the Middle West states and some others
Plan 2 In use in full or in principle by practically all the Atlantic Coast states and some others
Plan 3 Defeated at official meeting called by Bureau of Animal Industry at Chicago, 1927, by vote of 10–11 states
Plan 4 Approved at official meeting called by Bureau of Animal Industry at Chicago, 1927, by vote of 23–12 states
Plan 5 Defeated at official meeting called by Bureau of Animal Industry at Chicago, 1927, by vote of 20–15 states
Plan 6 Proposed by Bureau of Animal Industry, April 5, 1928
Plan 7 Proposed by several North Central Atlantic Coast states The Northeastern Plan except for substituting the word 'Standard' in place of 'Supervised' in the 3rd Grade and combining two original R O P Grades

Plans 1, 3 and 6 are identical in principle with Plans 2, 4, 5, and 7 except that the three plans first mentioned—1, 3, and 6—use the word 'Accredited' to indicate Breed Improvement and Sanitation and also Disease Eradication by prefixing B W D

Plans 2, 4, 5, and 7 use the word 'Accredited' exclusively to indicate Disease Eradication, prefixing B W D to indicate free In this respect Plan 7 conforms to the terminology officially approved by the Bureau of Animal Industry in December 1918 as applying to cattle

† Following are other terms which have been considered for the 3rd Grade U S Commercial, U S Selected, U S Approved, U S Grade B or U S No 2

improvement in the United States The plan developed was known as the Manhattan Plan Professor James E Rice, in 1928 writing in the *Poultry Item* of the proposals for a uniform poultry improvement program presented a table which is reproduced at the end of this chapter (Table 5-1) It was from these proposals that the National Poultry Improvement Plan evolved

NATIONAL POULTRY IMPROVEMENT PLAN

(Those who want the current detailed program should consult *U S D A Misc Publ* 300)

This plan became operative July 1 1935 It developed and was adopted by the poultry industry of the United States to fill a need that existed in the industry Its objectives were to improve the breeding and production qualities of poultry and to reduce losses from pullorum disease

The acceptance of the National Poultry Improvement Plan was made optional for states and individuals Some critics of the plan have questioned its voluntary and optional character since plan participants may use eggs chicks or stock from non participants only with the permission of the official state agency However it would be a very loose program if it permitted the use of any and all stocks regardless of their standards or supervision Most hatcheries and breeding flocks in the leading poultry states are participating in the National Plan (See Tables 5-2 and 5-3)

General Provisions of the National Poultry Improvement Plan

The National Poultry Improvement Plan provided that each state desiring to participate should establish an official state agency to administer the plan within the state This agency may be a state department of agriculture state college of agriculture or a state poultry improvement board or association

The general provisions of the plan strive to establish a uniform national program without restricting the states in carrying out the program There will always remain in this as in other fields conflicts between the concept of central authority vs states rights which must be compromised in order to establish a sound but workable program

Breeding Stages of the National Poultry Improvement Plan

The breeding stages of the National Poultry Improvement Plan have been criticized more than the disease control classes There are those

Table 5-2 Hatchery participation in the National Poultry Improvement Plan, by states and divisions, 1951–1952 and 1952–1953

	1951–1952		1952–1953	
State and Division	Number	Egg Capacity	Number	Egg Capacity
Maine	68	3,345,992	57	3,701,056
New Hampshire	72	5,424,000	73	5,581,700
Vermont	18	390,480	15	368,780
Massachusetts	196	6,220,804	170	5,875,292
Rhode Island	10	596,060	13	637,160
Connecticut	107	5,617,527	92	5,422,495
New York	189	7,442,000	166	7,214,161
New Jersey	92	10,037,720	94	12,259,930
Pennsylvania	185	14,439,514	199	15,314,722
North Atlantic	937	53,514,097	879	56,375,296
Ohio	206	16,340,946	199	18,644,945
Indiana	262	30,162,000	244	28,028,000
Illinois	221	31,563,331	202	29,338,542
Michigan	110	8,392,341	109	8,268,816
Wisconsin	70	4,449,120	65	4,423,220
East North Central	869	90,907,738	819	88,703,523
Minnesota	243	24,284,232	232	23,334,564
Iowa	147	15,808,400	132	14,387,700
Missouri	222	31,555,696	208	30,337,864
North Dakota	43	3,514,509	41	2,954,413
South Dakota	55	4,274,780	52	4,453,540
Nebraska	72	7,567,722	73	7,756,102
Kansas	158	12,266,942	136	11,001,884
West North Central	940	99,272,281	874	94,226,067
Delaware	27	9,657,780	23	9,648,500
Maryland	63	13,558,560	64	14,255,360
Virginia	97	13,285 869	98	14,093,169
West Virginia	26	2,240,548	26	2,365,492
North Carolina	171	11,358,870	172	12,010,070
South Carolina	39	2,269,707	39	1,889,707
Georgia	133	16,025,521	115	13,306,330
Florida	95	4,327,981	93	4,649,211
South Atlantic	651	72,724,836	630	72,217,839
Kentucky	100	5,477,264	96	5,711,348
Tennessee	68	4,682,516	63	4,466,376
Alabama	84	5,200,448	80	5,892,630
Mississippi	82	5,251,441	75	5,675,103
Arkansas	75	6,000,320	67	5,620,680
Louisiana	56	1,906,920	45	1,898,708
Oklahoma	64	5,550,888	58	5,142,188
Texas	104	9,811,392	85	8,159,678
South Central	633	43,881,189	569	42,566,711
Montana	15	1,307,700	14	651,940
Idaho	33	1,439,480	34	1,467,200
Wyoming	6	203,080	6	203,080
Colorado	37	2,019,000	33	2,734,500
New Mexico	4	143,000	4	143,000
Arizona	8	354,000	7	251,000
Utah	20	1,699,780	18	1,487,980
Washington	49	3,933,914	54	4,093,428
Oregon	63	3,909,404	61	3,875,350
California	124	13,506,804	101	11,533,999
Western	359	29,416,162	332	26,441,483
United States	4,389	389,716,303	4,103	380,530,919

Table 5–3 Flock participation in the National Poultry Improvement Plan, by states and divisions 1951–1952 *and* 1952–1953

State and Division	1951–1952 Flocks	1951–1952 Birds	1951–1952 Av Birds per Flock	1952–1953 Flocks	1952–1953 Birds	1952–1953 Av Birds per Flock
Maine	665	1 513 785	2 276	647	1 319 120	2 039
New Hampshire	554	1 729 328	3 122	463	1 494 676	3 228
Vermont	205	221 296	1 079	207	219 030	1 058
Massachusetts	587	989 131	1 685	408	932 442	2 285
Rhode Island	40	54 338	1 358	57	55 995	982
Connecticut	249	626 988	2 518	200	577 256	2 886
New York	04	870 159	1 165	598	810 326	1 355
New Jersey	649	943 698	1 454	618	1 072 786	1 655
Pennsylvania	1 3 9	1 694 719	1 279	2 506	1 565 177	625
North Atlantic	5 037	8 593 442	1 708	5 04	7 996 808	1 407
Ohio	6 787	1 718 818	253	6 255	1 678 010	260
Indiana	11 167	2 756 114	247	9 904	2 658 541	268
Illinois	10 123	2 357 201	233	8 915	2 075 641	233
Michigan	1 767	659 450	373	1 771	715 872	404
Wisconsin	1 0 0	356 163	333	1 005	347 681	346
East North Central	30 914	7 847 746	254	27 850	7 425 745	267
Minnesota	4 534	1 868 281	412	4 250	1 810 110	426
Iowa	5 111	1 331 439	261	4 472	1 211 102	271
Missouri	16 656	3 575 286	212	13 461	2 916 903	217
North Dakota	905	198 571	219	747	158 677	212
South Dakota	1 252	337 102	269	1 073	301 456	281
Nebraska	2 073	517 241	250	1 788	500 620	280
Kansas	3 935	926 314	235	3 254	769 324	236
West North Central	34 466	8 704 234	253	29 045	7 668 192	264
Delaware	512	593 033	1 158	467	525 287	1 125
Maryland	1 696	626 165	369	1 368	559 999	409
Virginia	1 841	887 362	482	2 004	996 104	497
West Virginia	957	193 510	202	997	197 287	198
North Carolina	3 342	1 775 804	531	3 100	1 653 916	534
South Carolina	389	202 301	520	308	170 748	554
Georgia	1 010	1 444 494	1 430	725	1 058 240	1 460
Florida	183	297 515	1 626	182	298 252	1 639
South Atlantic	9 930	6 020 184	606	9 151	5 459 833	597
Kentucky	3 592	536 672	149	3 290	507 551	154
Tennessee	1 625	292 787	180	1 276	326 862	256
Alabama	883	4 9 273	543	697	425 729	611
Mississippi	414	295 420	714	367	299 649	816
Arkansas	1 089	553 066	508	807	443 970	550
Louisiana	360	129 833	361	331	213 851	646
Oklahoma	1 618	308 791	191	1 428	295 323	207
Texas	1 332	558 171	419	888	437 357	493
South Central	10 913	3 154 013	289	9 084	2 950 29?	325
Montana	209	60 817	291	157	44 054	281
Idaho	475	113 236	238	344	113 504	330
Wyoming	62	11 264	182	47	7 300	155
Colorado	36	183 847	250	549	138 763	253
New Mexico	17	8 313	489	22	8 894	404
Arizona	16	9 304	582	17	5 454	321
Utah	149	128 836	865	95	93 156	981
Washington	650	5 8 014	859	4 8	480 535	1 005
Oregon	919	531 596	5 8	739	458 236	670
California	1 601	1 578 779	955	956	984 078	1 079
Western	4 834	3 154 006	652	3 404	2 333 924	683
United States	96 089	37 473 625	390	84 238	33 834 794	402

who object to the government's labeling (indicating breeding stages or grades) such products as chicks, which must be classified according to the methods used in their production instead of by their own visible merits The principle of establishing standards for the production of antigens, vaccines, etc, has long been accepted by the agricultural industries as proper and necessary for the protection of agriculture Sanitary conditions prevailing in a poultry dressing plant are also con sidered by the U S D A Grading and Inspection Service in grading poultry

U S Approved Hatcheries, Flocks, Eggs, and Chicks

This breeding stage or grade is based primarily on the physical selection of the individual birds used for breeding purposes The selection pressure will vary according to selecting agents and from hatchery to hatchery It is generally recognized that this breeding stage does not represent an advanced system of breeding, but in the program of many hatcherymen it has resulted in marked improvement in the quality of chicks sold

U S Certified Hatcheries, Flocks, Eggs, and Chicks

This breeding stage is based on selected females mated to U S R O P males and therefore represents an advance above U S Ap proved in breeding for egg production

U S R O P. (United States Record of Performance)

This breeding stage is based on trapnesting, pedigreeing progeny testing and family breeding It represents the best program the poultry breeders participating in the National Poultry Improvement Plan have been able to agree upon and develop

This breeding stage has been criticized by some, but the answer to all such criticism appears to be that all poultry breeders should work together and attempt to develop the best program that can be used by the industry The National Poultry Improvement Plan provides a place where they may cooperate in developing such a program

There is much to be said for the argument that the National Poultry Improvement Plan should not spell out in detail the exact breeding program (U S R O P) to be followed, but that it sponsor tests (Random sample, etc) by which the different strains mav be evaluated There may be a middle course of action here in which both goals may be achieved, a National Poultry Improvement Plan with progressive breeding stages or grades and tests for evaluating the progress being made

Pullorum Control

The Plan has been highly successful in reducing pullorum infection in poultry, and we may look forward to the ultimate eradication of this disease It has now been established that there are several other egg-borne diseases The control of some of these can no doubt be incorporated in the National Poultry Improvement Plan, and the pullorum control classes may become disease control classes

In 1935 the National Poultry Improvement Plan recognized as U S *Pullorum Tested any flock that has been tested for the disease, from* which the reactors have been removed regardless of the amount of reaction Today most states will not recognize a flock as participating in the National Poultry Improvement Plan unless it has at least one clean test for pullorum disease Beginning in 1955 all flocks participating in the Plan must have at least one clean test and be recognized as U S Pullorum Passed or U S Pullorum Clean

Hatcheries following the National Poultry Improvement Plan supply chicks that live unusually well (see Chap 4)

The Plan Is an Evolving Plan

The National Poultry Improvement Plan was first adopted in 1935 to serve the industry of that day It has been amended annually and biennially ever since in an effort to keep pace with changing industry It is not easy to develop a plan for an industry as diverse as the poultry industry of the United States It is impossible to satisfy all states and breeders The majority must of necessity determine the final Plan accepted at each annual (now biennial) conference to which each state sends its own elected delegates The Plan provides that the official delegates shall be elected by a representative group of participating industry members This places the responsibility of selecting each state's delegate upon the participating members within that state and grants to them complete freedom of choice of delegates Some would *like to impose restrictions upon the states' right to choose their own* delegates by having the Plan establish qualifications for delegates

TENDENCY TOWARD MONOPOLY AND RESTRAINT OF TRADE

There is always a temptation for producers in deficit producing areas for any commodity to try to develop trade barriers to keep out competition Imaginary and real reasons can be found for such barriers

Generally they are clothed in terms of disease control or health hazards. Sometimes products produced in other states must be so labeled in the hope of casting some stigma upon the products shipped into the state. One of the qualities that has made the United States a great country has been the diversity of its natural resources and the free flow of goods throughout the nation. Any state laws or regulations that restrict such trade tend to weaken the nation as a whole. The trend toward state trade barriers in the poultry industry has on the whole been reduced by the National Poultry Improvement Plan. Before the advent of the Plan many states had enacted laws or promulgated regulations designed to keep chicks from being shipped into their states.

With a uniform national plan in operation the states have accepted more readily chicks and hatching eggs produced in other states. However, it should be noted that some states have attempted to restrict shipments from other states to National Plan products. This has of course brought undeserved criticism on the Plan for action taken by individual states which the Plan as such could not prevent.

Trade Names and Franchises

Industry has for many years attempted to establish partial monopoly by differentiating its products so as to create a condition wherein the purchaser believes he is getting a different product when he buys a trade name aspirin, for example, instead of aspirin. More recently this same situation has arisen with respect to poultry, in that breeders have trade-marked names which they advertise.

Some breeders have also developed a franchise system, whereby certain selected hatcherymen only may sell their stocks in assigned areas. There is a definite tendency away from advertising the standard varieties of poultry toward the advertising of special named strains, etc. It is not within the scope of this book to say whether this trend toward trade names and franchises is for the best interests of the industry. Only time will tell.

There are those who believe that within a few years a few firms will be doing all the poultry breeding, as a few firms now manufacture all American automobiles. Those who hold this view, no doubt, believe the public agencies and improvement associations should not encourage the small independent poultry breeder, because he is doomed to failure as a result of competition from a few large firms.

TESTING STRAINS FOR USE BY HATCHERIES

Hatcheries as multipliers are continually confronted with the problem of selecting the most profitable strains for their customers This is not easy to do Before 1910 they were selected by form and feather and their showroom winnings Later egg laying contest records and home trapnest records were consulted but these did not prove too satisfactory because a highly selected sample only was trapped to make these records More recently the Random sample test has been used in a small way to test strains Many hatcherymen have learned that what really counts is how well a strain performs in the hands of their chick customers

The most practical way for a hatcheryman to test egg producing strains would seem to be to get his chick customers to keep some simple records showing monthly egg production and mortality The broiler producer is soon aware of the efficiency of the strains he uses, and the hatcheryman soon finds this out.

Unless the public and hatcherymen are made to realize that in a contest or test all those who finish in the upper 20 or 25 per cent are probably equally good and if the test were repeated possibly any one of them might be first such tests may do more harm than good The industry has seen the clamor for certain strains only because they won a contest

ORGANIZED POULTRY IMPROVEMENT PROGRAM

There is much to be gained by organized poultry improvement programs

State Programs

Each of 47 states now have a poultry improvement association or a similar organization sponsoring poultry improvement work. Many of these were organized or became active after the National Poultry Improvement Plan became operative They serve many useful purposes for the breeders and hatcherymen located within the respective states They bring these groups together to discuss their problems exchange ideas and act upon common industry problems

They supervise the poultry improvement work within their states They send state delegates to the American Poultry and Hatchery Federation conventions to National Turkey Federation meetings and to

the National Poultry Improvement Plan conferences Thus they participate in the national affairs of their industry

United States Department of Agriculture

The Bureau of Animal Industry of the United States Department of Agriculture has served, since the advent of the National Poultry Improvement Plan, as the coordinating agency for this poultry improvement program It is evident that, if a uniform national program is to be maintained, some national agency must coordinate the work Since the other work of the Bureau of Animal Industry is so closely related to the poultry industry it was logical that this bureau was chosen as the agency to coordinate the work of the National Poultry Improvement Plan

Research and Poultry Improvement

Since poultry breeding work is relatively new and its goals shift from time to time it is highly desirable that research in this field be carried on by public agencies such as the agricultural experiment stations and the United States Department of Agriculture Within recent years regional poultry breeding laboratories have been established An example of what a public service research institution may do for the industry is illustrated by the development and release of the Beltsville Small White turkey This turkey was developed by the Bureau of Animal Industry and released to interested breeders, who in turn bred these turkeys and sold them to the public There was no competition with industry and all the people benefited

Private Breeders the Key to Poultry Improvement

The private breeder, whether an individual, partnership, or corporation, is the important factor in poultry breeding They will continue to breed better poultry in the United States The improvement made to date has been the result of their efforts Public agencies should encourage and assist them in every reasonable way to do a better job in breeding better poultry for the use of the poultry industry and the American public

THE SCIENCE OF POULTRY IMPROVEMENT

Since the late twenties a science of poultry improvement has been slowly evolving During this period the science of genetics has been applied to the solution of practical, poultry breeding problems, and

the inheritance of several economic characters of poultry has been established During this same period progress has been made in the control of poultry diseases such as pullorum

With this background and the examples of some breeders and experiment stations, the industry now appears ready to develop its improvement work or programs on a more scientific basis than in the past There will be more education and less emphasis on regulation

The poultry industry is beginning to understand that poultry breeding is a science, and trained geneticists are being employed to direct breeding operations for some firms This will expand

In order to serve their members poultry improvement associations and boards will employ geneticists who are well trained and who command the respect of the industry These men will work with members of the poultry industry in an advisory capacity in setting up and operating breeding programs

We may also look forward to the use of specialists in poultry disease control work As more veterinarians are trained they will become available for service in the poultry industry They can be of real service in the program of poultry associations directed toward improving the control of poultry diseases which are disseminated through the hatcheries

6

Breeds, Varieties, Strains, Crosses, and Grades of Chicks

Chick purchasers are no longer satisfied to buy a breed or variety of chickens; instead they want specific strains or crosses bred and tested for the qualities they need for their production This demand may be expected to increase as the industry becomes more specialized and more efficient in production.

Though the American Standard of Perfection recognizes more than 150 varieties of standard-bred poultry, the poultry industry is now raising only a relatively few varieties of standard-bred poultry but is making many crosses with a few of these purebreds Within the United States only three classes of poultry are now commonly raised. They are breeds belonging in the American, English, and Mediterranean classes. An analysis of the NPIP selecting reports on flocks kept for breeding purposes by participants in the National Poultry Improvement Plan for 1952–1953 showed (Table 6–1) that three varieties (New Hampshires, White Leghorns, and White Rocks) make

Table 6–1 *Summary of breed distribution in National Poultry Improvement Plan*

Hatchery supply flocks 1941–1942 to 1952–1953

Total Number of Birds and Percentage Distribution by Varieties for All States Reporting

Year	States	Total Birds	New Hampshire	White Leghorn	White Rock	Barred Rock	Rhode Island Red	Crossmated	Incrossmated	Other
1941–1942	33	10,712,027	21 2	24 1	15 6	16 2	12 5	2 0		8 3
1942 1943	40	15 780,980	19 2	26 6	18 3	15 7	8 9	3 0		8 3
1943–1944	42	20 331,999	19 4	25 9	19 7	13 9	8 3	5 5		7 3
1944–1945	39	17,573,321	20 6	25 8	17 5	12 4	8 0	9 8		6 0
1945–1946	32	20,256 904	23 8	23 1	17 0	11 4	7 7	11 3	.	5 7
1946–1947	38	24 490,346	23 4	25 4	17 4	10 0	6 5	11 1		6 2
1947–1948	42	25,148,247	25 9	24 7	15 2	10 2	6 8	12 4	.	4 8
1948–1949	44	26,458,372	31 9	25 7	13 2	7 8	5 6	11 9		3 9
1949–1950	47	36,195,375	38 8	21 9	10 4	6 2	4 3	15 1		3 2
1950–1951	47	33 804,603	38 9	21 6	10 1	5 8	4 1	16 4	.	3 1
1951–1952	47	37,559,597	41 4	18 9	11 9	4 0	3 3	14 3	3 4	2 8
1952–1953	47	33,847,682	36 2	20 1	14 8	3 5	3 2	16 0	4 0	2 2

up over 70 per cent of the flocks participating in the National Poultry Improvement Plan.

STANDARD CLASSES

American Class

This class of chickens includes those breeds and varieties developed in North America. Their ancestors were primarily of the Asiatic class. Only four or five of the breeds or varieties of this class are now generally raised, the more popular being the New Hampshires, White Plymouth Rocks, Rhode Island Reds, and Barred Plymouth Rocks.

These breeds are characterized by their yellow skin, non-feathered shanks, red earlobes, and by laying brown-shelled eggs. They are used for eggs, meat, or general purposes, depending upon the way in which strains of these varieties have been bred.

English Class

The only breeds in this class now popular in the United States are the Cornish and the Black Australorp. The Cornish are used for

FIG 6–1. White Cornish male.

crossing with other breeds to produce chicks for broiler production. This breed is noted for small eggs, and few of them but has an unusually well-developed breast for meat production. (See Fig 6–1.)

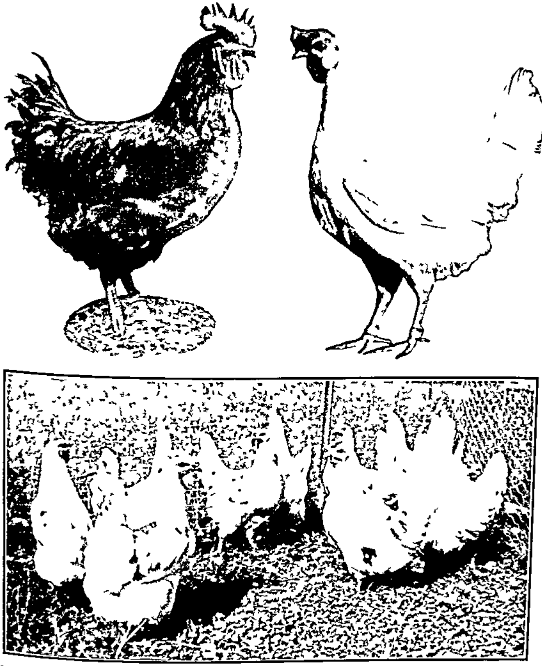


Fig 6–2 Black Australorp males mated to White Leghorn females produce Austra-Whites

The Black Australorps retain their popularity as a source of males to cross with White Leghorns to produce Austra-Whites, which are in demand for egg production in some areas (See Fig. 6–2.)

Mediterranean Class

The variety of this class that remains popular is the Single Comb White Leghorn, which is generally considered to be the most efficient purebred in the United States for the production of eggs (See Fig 6–2) The bloodlines of this variety have also played an important role in the production of inbred hybrids and crosses used for egg production

This breed developed in the Mediterranean area and named after Leghorn, Italy, is an egg breed of small or average size, having yellow skin, non feathered shanks, white earlobes, and laying white-shelled eggs They are relatively nervous and are generally non broody

They are gaining in favor as caged layers because of their white eggs and also because of their efficient production The Random sample tests, and other tests where feed efficiency for egg production is measured, favor a high producing bird of small size such as the White Leghorn

STRAINS

Strains for Specific Purposes

As the poultry industry has become more commercialized and specialized it has demanded strains for the specific purpose of producing meat (broilers), eggs, or a general purpose bird.

The poultry industry of the United States has developed an enormous broiler industry (about 1 billion birds now being produced annually) This industry is highly commercialized and highly competitive Accurate records are kept by many producers so that they can determine the efficiency of each lot of broilers Thus, they soon learn which strains are the most efficient converters of feed into pounds of live chicken

The more popular purebred strains of poultry used for broiler production are the meat strains of New Hampshires and the meat strains of White Plymouth Rocks

Strains for Egg Production

The commercial egg producer is no longer satisfied with Leghorns or S C White Leghorns he insists instead on strains of S C White Leghorns which he believes possess the qualities that result in efficient egg production under his conditions The demand for such strains will, no doubt, continue There are a number of such strains

in S C White Leghorns, R I. Reds, Barred Rocks, and New Hampshires, which have given a good account of themselves over a period of years in egg-laying contests and in U S R O P. work The hatcherymen looking for better strains for egg production would be well advised to study carefully the long time egg-laying contest summaries issued annually by the Council of American Official Poultry Tests (Rutgers University, New Brunswick, N J), the U S. R O P. summary published annually by the Bureau of Animal Industry, and the reports of the Random sample tests

Strains for General-Purpose Farm Use

Though most poultry breeders have accepted the cattle-breeding theory that one should breed for dairy or beef type, some poultry breeders persist in an effort to breed a chicken which lays well and also converts feed to meat in an efficient manner. Some of these breeders have produced a very fine chicken for general farm use, one that produces enough eggs to satisfy the hatchery supply flock owners

CROSSES

Crosses for Broiler Production

Lately there has been a definite trend toward crossbred chicks for broiler production The first of these crosses that became popular was the Barred Rock × Red or New Hampshire or the reciprocal cross of these breeds If barred males are used all the offspring will be barred (See Fig 6–3) If Red or New Hampshire males are used, the male progeny will be barred and the females black with some red showing on the neck and breast These females have proved popular in the East for both egg production and meat (fowl) production

There is a definite trend in many areas at present for white feathered broiler birds This has brought forth a great many kinds of "Dominant White" male lines to be used in crossing on colored females, notably New Hampshire and Barred Rock, for producing a nearly all-white plumage broiler crossbred with the vigor and efficiency of feed conversion of the original Barred crosses The Dominant Whites include various White Rocks pure for Columbian color pattern, as well as Cornish and other heavy-type chickens, with perhaps some White Leghorn in their background to give the color-inhibiting factor of the Leghorn for the effect of "dominance" when crossed

Delaware New Hampshire Cross The market demand for white chickens (broilers) created a demand for a cross that was all or

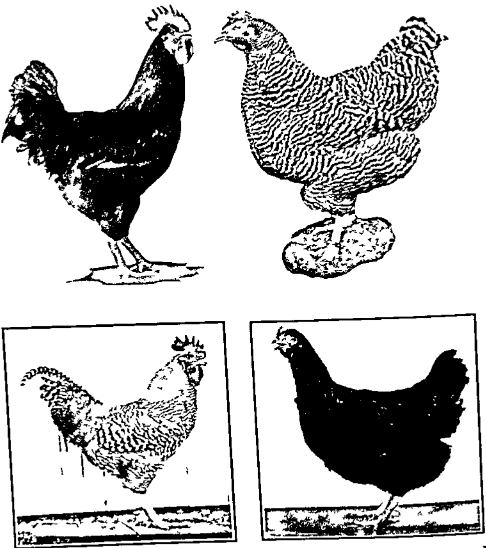


Fig 6–3 Red males mated with Barred females produce black pullets and barred males

mostly white The Delaware chicken, when crossed on New Hampshires, was found to give a broiler that was white, except for some black or gray markings in the neck and tail feathers (See Fig 6–4)

Another cross with New Hampshires has been the use of White Wyandotte males which carry the dominant white character and, therefore, produce a white chick for broiler production This cross

is called the Eureka The growers have had difficulty with poor feathering and too many gray colored broilers

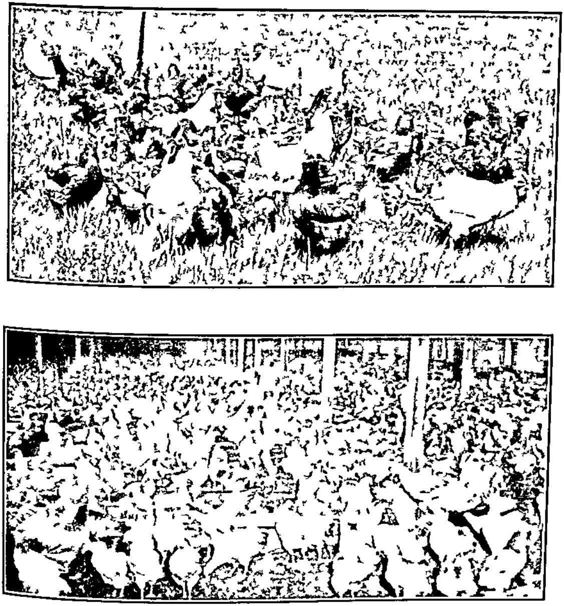


Fig 6–4 Delaware males × New Hampshire females produce a near white broiler

Cornish Crosses Although the Cornish crosses have good breast fleshing, many have not found particular favor in broiler areas because they lack uniformity of size at broiler age, hatchability is poor, and rate of growth is often not equal to that of some of the better pure bred strains or crosses One or two strains of Cornish are notable exceptions to the above general observation, and these strains have found generally wide acceptance

Crosses for Egg Production

Leghorns crossed with Rhode Island Reds or New Hampshires have proved to be efficient producers of eggs

A popular cross for egg production has been the Austra White (a Black Australorp male × White Leghorn females) The hybrid vigor resulting from this cross has given the producer a bird that lays rea sonably well and lives well They produce tinted eggs, have dark shanks, and sometimes black skin on the thighs, which causes marketing agencies to discriminate against them

The Austra White is becoming popular where layers are kept in cages They are hardy and do well in cages There is less broodiness when they are confined to batteries or cages than when they are on the floor

Hybrids or Incrossbreds for Egg Production Breeders cross inbred lines to produce incrossbred or hybrids The methods used are some what similar to those used in producing hybrid corn and this similar ity has been cited in promoting such hybrid poultry

The production of inbred lines, and finding the best combinations to distribute commercially, is an expensive process If this system of breeding should prove far superior to the production of purebreds and crossbreds, the breeding of poultry might pass into the hands of a few large corporations Only the future can answer that question

GRADES OF CHICKS

Most hatcherymen and breeders find it necessary to sell different grades of chicks in order to meet competition and satisfy their cus tomers Grades of chicks are justified only when there are differences in their quality

The industry needs better identification of strains for meat and strains for egg production Too many meat strains have been sold to farmers who thought they were getting stock that would produce eggs efficiently As a result, in many areas production bred New Hampshires have lost their popularity because the farmer has come to associate the name New Hampshire with meat production

Hatcherymen and breeders should make clear what their strains are bred for eggs meat or general purposes

If the industry is to have identification of grades of chicks there must first be identification of the stock that produced the eggs and the eggs

must also be identified The only dependable way to identify the breeding stock is by sealed wing bands issued by some official state agency Sales records are necessary to show the movement of such stock

THE DEMAND FOR DIFFERENT BREEDS, VARIETIES, STRAINS, AND CROSSES

There has been considerable shifting of demand from the purebreds to crosses and to meat production types (See Table 6–1)

The demand for Missouri hatching eggs of different varieties is shown in Table 6–2 This demand is primarily for broiler strains and comes principally from the southern broiler producing states

Table 6–2 *Rank of the breeds, varieties, and crosses represented in Missouri s hatching eggs sold in* 1952

Rank		Dozens	Percentage
1	New Hampshire	2,274,564	40 07
2	Delaware × New Hampshire	1,245,972	21 95
3	White Plymouth Rock	980,088	17 27
4	Cornish × New Hampshire	343,816	6 06
5	White Leghorn	206,312	3 63
6	White Wyandotte × New Hampshire	203,861	3 59
7	Rhode Island Red	120,962	2 13
8	Barred Plymouth Rock	77,062	1 36
9	Black Australorp × White Leghorn	42,639	0 75
10	White Wyandotte	35,872	0 63
11	Barred Rock × New Hampshire	31,446	0 55
12	New Hampshire × White Leghorn	25,908	0 46
13	Delaware	18,862	0 33
14	Jersey White Giant	11,787	0 21
15	Buff Orpington	8,715	0 15
16	White Cornish × White Rock	6,748	0 12
17	Jersey Black Giant	5,950	0 10
18	Brown Leghorn	4,718	0 08
19	Black Minorca × White Leghorn	3,510	0 06
20	White Wyandotte × White Rock	3,212	0 06
21	True Line	2,905	0 05
22	Ancona	2,701	0 05
23	Dark Cornish	2,498	0 04
24	Delaware × Rhode Island Red	1,994	0 04
25	Columbian Plymouth Rock	1,800	0 03
	All Others	12,756	0 22
		5,676,658	

Deciding What to Produce

The hatcheryman has to be alert to changes in demand and be ready to meet them If he guesses wrong he may be seriously injured financially The one who goes all out for one strain or cross and gets on the band wagon may make a killing, but also he may be left holding the bag A more conservative approach is to keep posted on develop ments, try out some of the strains or crosses, and see how they work out Very frequently the "fever' for some new chicken subsides after it has met the acid test of the producer

Speaking at the Missouri Hatchery Short Course in 1953, Dr. W F. Krueger presented the following information on breeding systems

> In recent years considerable emphasis has been placed on hybridization or hybrids in poultry Current, but limited, controlled experimental work indicates that certain strain or breed cross combinations have some advantage over the pure strains involved in the particular cross This does not mean that all strain, breed, topcross, or inbred hybrid combinations are superior to the pure strains It does suggest, however, the possibility of improving performance by careful selection of strains with good "nicking" or combining ability *Only when the strains show high combinability ("nickability") will there be any advantage from crossing or hybridizing*
>
> Limited experimental data suggest that there is, on the average, about a 2 to 3 per cent advantage in egg production from strain crossing, about a 4 per cent advantage from breed crossing, and 4 to 6 per cent from topcrossing over the pure strains going into the cross combinations To offset this increase in production, there is a slightly higher adult mortality in cer tain cross combinations There also is a tendency for more broodiness in some hybrid combinations Thus, on a hen housed basis the best purebred and hybrid combinations are about equal There is little doubt that in most cases good hybrid combinations will out lay many purebreds produced by hatcherymen The day of driving down the public road looking for hatchery supply flocks whose history is unknown appears to be on its way out Pur chasers of chicks for egg production are becoming more and more perform ance-conscious This means the hatcheryman must take on the role of "semibreeder" to make sure his customers are getting chicks which will meet competition
>
> Hatcherymen and breeders want to know what strains combine the best They also want to know how to get information on these strains as fast as possible with as few records as possible The following pages describe each of these hybridizing systems applicable to hatchery operations A fairly simple testing program using hatchery supply flocks and farm flocks is out lined Testing programs such as those to be mentioned are being used with success In many cases they only involve average egg production and mor tality records on each test flock

STRAIN CROSSING

Strain crossing may be defined as the mating of birds belonging to different strains within the same breed and variety Diagrammatically the mating system would appear as follows where *A* and *B* are actual breeders whose strains you would like to use

Non Inbred White Leghorn (Strain *A*) Males	Non Inbred White Leghorn (Strain *B*) Females

AB
Strain Cross Leghorns
(for commercial chick production)

Since we are attempting to take advantage of combinability or hybrid vigor, it is important that strains *A* and *B* be (1) good performing strains, (2) pure strains (not strain crosses), and (3) maintained as pure strains A fourth requirement which cannot be overlooked is combinability The two strains must, when crossed, show hybrid vigor or time is wasted This may mean that a hatcheryman or breeder will have to test several combinations (strains *A* with *B*, *A* with *C*, *B* with *C*, etc) in order to find two strains that "nick' well This can be done through proper organization of a flock owner system or by observing farm or commercial flocks possessing these combinations If 12 farm flocks could be used, the system would look like this, with modifications

Production of Pure Strain or Strains

Flock owner 1	$A \times A$ (hatcherys select strain which is one of his key flocks for flock replacements)
Flock owner 2	Same as flock 1 or as many flocks as hatchery man thinks he needs

Production of Strain Crosses Which Interest Hatcheryman

Flock owner 3	Strain *B* males mated with his own strain *A* females to produce *BA* strain crosses to supply test flocks and for commercial sales
Flock owner 4	Strain *C* males mated with his own strain *A* females to produce *CA* strain crosses to supply test flocks and for commercial sales

Test Flocks to Check the Value of the Strain Crosses

Flocks may be used to produce 3 way crosses (*ABC* strain crosses) for commercial sales in addition to getting valuable strain cross information

Flock owner 5	Gets strain cross *BA*	Average of these four flocks measures value of *BA* strain cross
6	" " " "	
7	" " " "	
8	" " " "	

Flock owner 9	Gets strain cross *CA*	Average of these four flocks measures value of *CA* strain cross
10	" " " "	
11	" " " "	
12	" " " "	

If the testing program is conducted within the flock owner system, it may mean the production of 3 way crosses (strain cross *AB* with Leghorn strain *C*, etc)

Example

Strain Cross *AB*
Which Flock
Owner Has

Non Inbred
Strain *C*
Males

Strain Cross *ABC*
(3 way cross)
(for commercial chick production)

Little performance should be lost from a 3 way cross if the three strains involved are unrelated This or similar testing programs can be conducted with success by breeders and hatcherymen if they so desire Records on average egg production, livability, and possibly egg size can be kept by farmers A minimum of 3 to 4 flocks per combination should give a fair measure of value of a specific strain cross It should be remembered that differences in feed management, and location under this program play a major role For this reason a cross should be tested at more than two loca tions (farms) Testing programs similar to this are being conducted by cer tain breeders and hatcherymen with rather fruitful results If the program is set up properly, it should produce valuable information within a year

From a hatcheryman's standpoint, it is not desirable to attempt to produce a pure line from an outstanding strain cross That is to say, if a certain strain cross does well one should not attempt to form a pure strain from it Chances are that such a mating will go to pieces This may explain why many strains drop in performance after being removed one or two genera tions from the breeder The supposedly pure strain from the breeder could have been a strain cross which after the first generation fell apart Once a hatcheryman has found a good strain cross combination it is advisable to obtain the pure strains from the breeders each year or bring in more new stock of the two strains each year By all means keep the two strains in their pure form It s the cross of the pure strains that we want if we are producing a strain cross or single cross hybrid

Besides Leghorns, strains of Rhode Island Reds and New Hampshires should work well in strain cross combinations

CROSSBREEDING

Another form of hybridization which has become popular in both egg production and broiler circles is crossbreeding. Defined, it is mating together birds of different breeds. The purpose is to combine as many different favorable genes (units of inheritance) from rather widely separated sources to obtain as much hybrid vigor as possible. Again one is interested in maximum combinability. Crossbreds should not be confused with inbred hybrids produced from crossing inbred lines.

In diagram, the mating system is as follows (for egg production):

Strain *A* White Leghorn Males		Strain *H* New Hampshire Females
	AH Leghorn New Hampshire Crossbreds (commercial chicks)	

Strains of Rhode Island Reds, Australorps and White Plymouth Rocks also have been found to combine well with selected strains of Leghorns. Rhode Island Red Barred Plymouth Rock crosses, provided the correct strains are used, do very well. There are probably other breeds of which the writer is not aware that may combine well for high production. This list does not include strains to which trade names have been attached.

Crossbreds are of no advantage to the commercial producer unless they perform better than the pure strains. This means that strains of different breeds must be crossed whose offspring give better than average performance in production, livability, and egg size. This requires a testing program to find out what strains of various breeds combine well together.

The testing program would by necessity resolve itself down to farm and commercial egg producing flocks because a hatcheryman cannot tie up his egg supply system with crossbreds. Again, about 3, 4, or more farm flocks per cross should give a reasonable picture of the value of a crossbred combination. Average production and mortality are all the data necessary.

One outlet for crossbred chicks often overlooked by hatcherymen is the possibility of mating a good strain of Leghorn males with New Hampshire females that are normally being used for the production of broiler chicks. There is evidence that *some* broiler strains of New Hampshires combine well with Leghorns producing a crossbred whose performance is above average, in fact, much better than progeny from pure broiler type New Hampshires not selected for reasonable egg production. This may be an outlet for good chicks during periods when broiler chicks are not moving too well. It would, however, require maintaining some Leghorn males which is objectionable. In many cases farmers interested in egg production alone would be much happier with these crosses than with some of the broiler strains being sold for egg production. This is not to suggest that all broiler strains are poor

egg producers Some breeders have done a good job of maintaining production and improving meat quality at the same time

TOPCROSSING

Some breeders are placing inbred males on the market for topcross matings Topcrosses are similar to strain crosses and crossbreds except that the breeding males are inbred males The matings are usually made as follows

Inbred Males of Strain A | Non Inbred Females of Strain B or Your Strain of Females

AB Topcrosses
(commercial chicks)

Usually the males are inbred Leghorn males The females can either be non inbred Leghorns or non inbred heavy breeds (New Hampshires, Rhode Island Reds, Australorps etc)

The topcross is of little value to the customer unless it performs as well or better than the available purebreds That means the two strains must combine or "nick" well for high production This again requires a testing program on the part of the hatcheryman

INBRED HYBRIDS

Although inbred hybrid (incrossbred) production is not applicable to most hatchery operations, enough interest has been developed to warrant a short discussion Inbred hybrids are actually crosses between two or more *inbred* strains of chickens The idea is to obtain as much "nicking" or hybrid vigor as possible and as much uniformity as possible Usually the matings are set up in the following way

Inbred Strain A (Leghorns) | Inbred Strain B (Leghorns)

Inbred Hybrid AB

Inbred Strain C (N H) | Inbred Strain D (R I R)

Inbred Hybrid CD

Now Mate AB Hybrids with CD Hybrids

Inbred Hybrid $ABCD$
(4 way cross)
(for commercial production)

This breeding system is expensive and is limited to those breeders whose means permit a breeding program such as this It requires considerable record keeping, time, and a knowledge of breeding principles and systems of breeding

SUMMARY

The value of strain crosses crossbreds, and topcrosses depends on the strains being combined The strains must 'nick well to give good production and livability This requires a testing program which breeders and hatcherymen can perform efficiently and economically with fairly reliable and quick results The value of the program depends on the man

One must keep in mind that strain crosses, crossbreds, and topcrosses must out perform the purebreds or they are of little value

7

Factors Influencing the Hatchability of Eggs

The hatching of an egg is a complex biological process by which nature maintains the continuity of the different species of birds. Many factors or conditions affect this process, some of which are known and others still unknown but which may be revealed by later research.

Hatchability is of vital concern to the hatcheryman because it directly affects his profits and may be the difference between profit and loss in the business. An increase of 5 per cent in the number of salable chicks produced by a hatchery setting 500,000 eggs annually would result in 25,000 additional chicks which at 15 cents per chick would be worth $3,750. Many hatcheries could increase their hatches by 5 per cent or more by applying the information on fertility and hatchability that is available at present and will be reviewed in this chapter.

The discovery of a method or process whereby fertility or hatchability of eggs set in the United States should be increased by 2 per cent would result in extra chicks valued at approximately $6,000,000 annually. This indicates how important it is to the industry for research in all phases of the problems of fertility and hatchability to be continued and expanded. Approximately 30 per cent of all eggs set in the United States fail to produce chicks.

The hatcheryman is interested in the number of salable chicks he can hatch out of the eggs purchased. This depends upon two general conditions, the fertility of the eggs and the hatchability of the fertile eggs.

FERTILITY

It is estimated that 10 per cent or more of the eggs set in the United States each year are infertile. Such eggs are not only a loss to the industry, but they occupy valuable incubator space and require time consuming labor in handling.

Fertilization, which is the union of the male sperm and the female egg, occurs naturally in the upper end (funnel portion) of the oviduct within about 15 minutes after ovulation The sperm may traverse the length of the oviduct within 26 minutes by means of its motility, ciliary motion in the oviduct, and antiperistaltic muscular action

Some eggs laid within 24 hours after copulation may be fertile, and within 2 weeks after a flock is mated satisfactory fertility may be attained Fertility in chickens may persist for 3 weeks and in turkeys for 7 weeks (See Fig 7–1) The removal of males from a flock is followed by a decline in fertility within 1 week in chickens and 2 weeks in turkeys If the males in a mating are changed, the eggs laid within a few days are fertilized by the new males, and there is very little overlapping in progeny

Some of the many factors affecting fertility are

Kind of sperm Sperm showing most motility soon after production give the highest fertility Semen containing a high percentage of abnormal sperm results in lower fertility than more normal sperm Sperm production of spring hatched males has been found to increase through the winter and early spring and decline during the late spring and summer

Rations Sperm production may be reduced by deficient or restricted rations Prolonged deficiency of vitamin E was reported by Adamstone and Card (1934) to result in sterility in some males Both sperm production and fertilizing capacity of cockerels were affected adversely by restricted feed consumption which resulted in loss of body weight (Parker and McSpadden, 1943) Adequate nutrition of the breeding flock is essential to fertility

Hormones and fertility The relatively new science of endocrinology has yielded valuable information with respect to fertility in poultry The removal of the pituitary gland causes atrophy (shrinkage) of the testes and the cessation of sperm production Males injected with pituitary extract and pregnant mare's serum produced more sperm than untreated controls Injections of male sex hormones have increased fertility Thiouracil, which reduces thyroid activity, reduces the fertilizing capacity of sperm The injection of adrenalin depresses sperm production

The amount of light received by the bird influences sperm production, the minimum amount of light required for normal production being about 12 hours daily

The dubbing of males does not affect fertility except indirectly, in that frozen combs and wattles and abnormally enlarged headgear may

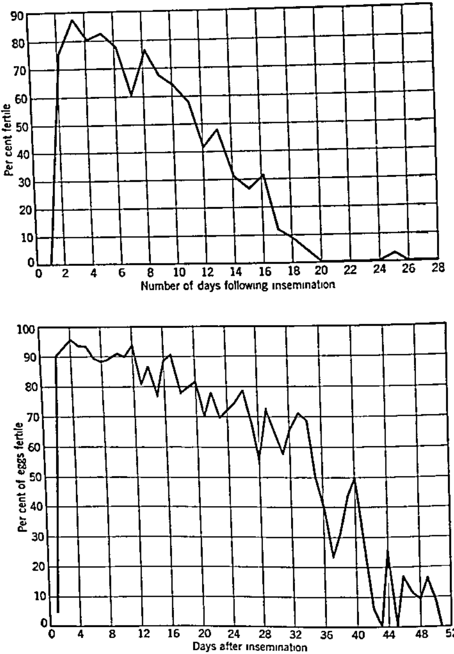


FIG 7-1 Duration of fertility in chickens and turkeys after artificial insemination Note the greater duration in turkeys (Turkey data, courtesy F W. Lorenz, University of California, chicken data, courtesy University of Missouri)

interfere with activity and feed consumption and thus decrease fertility.

Age and fertility. Fertility in both males and females is at a maximum during the first or yearling year and generally declines thereafter with age. Though fertile eggs may be produced by hens mated with cockerels 10 weeks of age, satisfactory fertility is not attained until the males are about 6 months old.

Egg production and fertility. Females laying at high rates of production tend to produce eggs which are more fertile than those laid by birds laying fewer eggs. The results reported (see Table 7-1) by Lamoreux show this relationship.

Table 7-1 The proportion of infertile eggs produced by 3 groups of hens which laid 13-22, 23-31, and 32-40 eggs, respectively, during a 6-week period, 1935–1939

(Lamoreux, 1940)

Year	Egg Production								
	13 to 22 Eggs in 6 Weeks			23 to 31 Eggs in 6 Weeks			32 to 40 Eggs in 6 Weeks		
	No of Hens	Eggs Laid	Infertile Eggs (%)	No of Hens	Eggs Laid	Infertile Eggs (%)	No of Hens	Eggs Laid	Infertile Eggs (%)
1935	16	320	26.2	102	2,860	18.2	55	1,844	9.9
1936	11	208	41.8	73	2,069	26.8	68	2,301	18.4
1937	34	657	17.8	125	3,460	12.4	41	1,367	11.2
1938	10	200	12.0	93	2,674	8.0	48	1,597	8.8
1939	15	288	24.3	104	2,922	12.6	61	2,046	16.4
Total	86	1,673	24.4 *	497	13,985	15.6 *	273	9,155	13.0 *

* Unweighted average of the percentages for the 5 years.

Preferential mating. That the fertility of eggs laid by some hens in individual male matings may be increased by changing males has been reported by several investigators. Possibly both males and females have their preferences. Some hens, completely sterile when mated with one male, lay highly fertile eggs when another male is used. The "peck order" that exists in fowl no doubt affects mating and fertility.

Seasonality. That fertility varies with the season is attested by the experience of most hatcherymen. Fertility tends to be high during the spring and low during the summer. Hot weather appears to have a

detrimental effect on fertility Figure 7-2 shows the seasonal variation in fertility for both White Leghorns and Barred Rocks

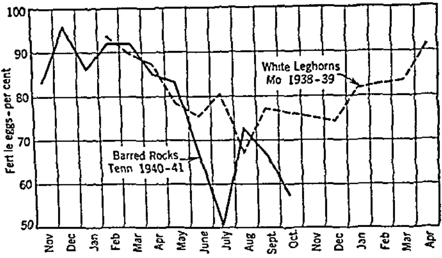


FIG 7-2 Seasonal variation in fertility of chickens (Courtesy Tenn Agr Exp Sta)

Breeding The fact that fertility varies with strains and breeds indicates some degree of inheritance of this trait, though of a low order Those who have investigated this problem do not agree The positive correlation between egg production and fertility in the more productive strains indicates that by breeding for increased egg production fertility may also be increased However, it should be noted that some low egg producing meat strains also have excellent fertility

Work at the California station indicates that fertility and hatchability are independent in inheritance That inbreeding reduces fertility in turkeys was shown by Marsden and Knox (1937) (See Table 7-2) Inbreeding also lowers fertility in chickens

Table 7 2 Summary of the egg fertility and hatchability, and of egg production and egg weight for 773 inbred and outbred Bronze turkeys

(Marsden and Knox, 1937)

Degree of Inbreeding	Coefficient of Inbreeding	Fertility, %	Hatchability, %	Production of Eggs to June 1, Number	Average Egg Weight, grams
Outbred	0 000-0 063	87 8	67 6	47 7	83 6
Mild	0 125-0 218	75 4	51 7	42 2	82 7
Close	0 250-0 411	82 8	52 8	39 0	82 1
Intensive	0 500-0 672	69 3	34 9	41 4	81 5

Artificial insemination Artificial methods for inseminating both chickens and turkeys have been developed It is not likely that such methods will become as common with poultry as with larger animals, but there are occasions when they can be useful

More progeny may be produced from a given sire by artificial insemination than by a natural mating This method may be used to advantage with hens confined to laying cages (batteries), with hens in large unmated flocks, and for injured or otherwise incapacitated males or females

Artificial insemination offers promise in increasing the fertility of strains of turkeys that give low fertility in natural matings Table 7–3 shows the results obtained at the Pennsylvania Agricultural Experiment Station (1951) using natural matings, artificial insemination, and combinations of both methods

Table 7–3 Effect of method of mating on reproductive ability of White Holland pullets

(McCartney, 1951)

Method of Mating	Total Eggs Set	Average Number Eggs Set *	Per Cent Fertile	Per Cent Hatch Fertile Eggs	Per Cent Hatch All Eggs	Average Number Poults†
			PERIOD 1			
Natural	2,153	76 9	81 3	66 9	54 4	41 8
Artificial	1,900	76 0	91 7 ‡	67 0	61 5	46 7
Combination	1,977	79 1	95 7 §	72 8	69 7 §	55 2 §
			PERIOD 1a			
Natural	679	24 2	71 1	57 5	40 9	9 9
Artificial	647	25 9	84 7	59 7	50 5	13 1
Combination	628	25 1	93 5 §	63 9	60 3 ‡	15 2
			PERIOD 2			
Natural	632	22 6	76 2	53 4	40 7	9 2
Artificial	617	24 7	83 0	57 2	47 5	11 7
Combination	573	22 9	86 9 ‡	58 4	50 7	11 6

Note Period 1, 18 weeks after onset of mating
Period 1a 6 weeks before changes in methods of mating
Period 2, 6 weeks after changes in methods of mating

* Average number set per female

† Average number of poults hatched per female

‡ The difference between this value and the value for natural mating is significant

§ The difference between this value and the value for natural mating is highly significant

HATCHABILITY

That hatchability is inherited has been shown not only by research workers, but most hatcherymen as well have observed this relationship in their hatchery operations However, too many poor hatching flocks have been retained as hatchery supply flocks, which should have been completely replaced by stock possessing the power to hatch well In building a flock program the hatcheryman should select strains that possess high fertility and hatchability so far as he can obtain such stock Unless the stock possesses such qualities all other management practices, though perfect, will fail to produce satisfactory hatches A selection program for vigor and vitality in the breeding stock will assist in maintaining high hatchability

Inbreeding Close inbreeding, without rigid selection for hatchability, has been shown to be detrimental to hatchability in both chickens and turkeys Most poultrymen endeavor to prevent not only inbreeding but also the mating of any related stock This is, of course, a mistake, as the best program for a multiplier such as a hatcheryman is to locate the strain that best serves his needs and to go back to that source each year for his stock or the males he needs The results of Marsden and Knox (1937) with turkeys presented in Table 7–2, illustrate the detrimental effect of inbreeding on hatchability as well as fertility

Crossbreeding and incrossbreeding Though the results of crossing pure breeds or incrossbreds will depend upon the characters or genes carried by the parent stock, such crossing usually results in increased hatchability Byerly's (1930) results (Table 7–4) are typical of the

Table 7–4 Effect of crossbreeding on hatchability

(Byerly, 1930)

Mating			Number of Fertile Eggs	Percentage Hatched
Male		Female		
Rhode Island Red	×	Rhode Island Red	1,666	66 4
White Leghorn	×	Rhode Island Red	245	76 5
White Leghorn	×	White Leghorn	809	50 5
Rhode Island Red	×	White Leghorn	1,303	56 2

improvements obtainable by crossing breeds having relatively low hatchability Results reported by Knox (1946) from incrossbreeding

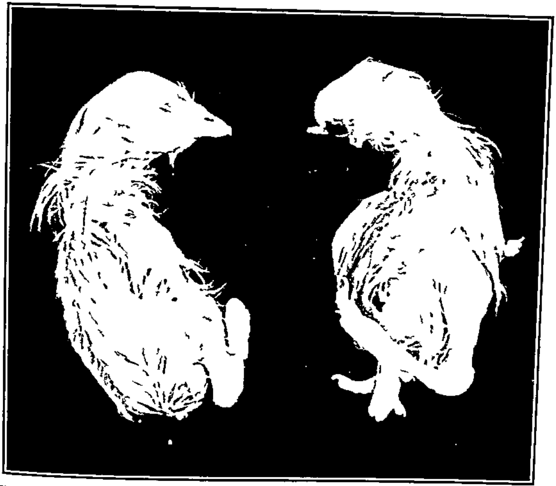


FIG 7–3 An inherited deformity at right which, by preventing the development of the beak, made pipping and hatching impossible (Courtesy Penn Agr Exp Sta)

are shown in Table 7–5 and indicate that generally incrossbreeding increases hatchability

Table 7–5 Effect of incrossbreeding on hatchability

(Knox, 1946)

Breed	Mating	Number of Eggs	Per Cent of Fertile Eggs Hatched
Rhode Island Red	Inbred	118	83 3
R I R × W L	Incrossbred	106	73 9
Rhode Island Red	Inbred	81	53 3
R I R × W L	Incrossbred	158	74 0
Rhode Island Red	Inbred	104	73 5
R I R × W L	Incrossbred	40	100 0
Rhode Island Red	Inbred	254	80 5
R I R. × W L	Incrossbred	113	90 7

Lethal and semilethal genes. The geneticists are gradually but continually discovering the genes in poultry (both chickens and turkeys) that cause the death of embryos and thereby lower hatchability. They have reported 19 in chickens and 3 in turkeys. The lethal effects of some of these genes stem from abnormalities which prevent hatching, such as deformed beaks as shown in Fig. 7–3.

Egg Production

Eggs laid by hens producing at a high rate are not only more fertile, but they also possess higher hatchability than eggs laid by poorer layers (Table 7–6).

Table 7–6. Relation of rate of production as measured by size of clutch to fertility and hatchability

(Funk, 1939)

Eggs Laid in Clutches of	Percentage Infertile	Percentage Hatch of Fertile Eggs
1 egg	29.2	58.9
2 eggs	24.1	67.6
3 "	21.8	71.5
4 "	16.6	72.4
5 "	19.7	71.2
6 "	20.7	78.0

Age

Hatchability tends to be highest during the first laying year for both turkeys and chickens (Tables 7–7 and 7–8).

Table 7–7. Effect of dam's age on hatchability of fertile eggs in chickens

Records for same hens in successive years *

Breed	No. of Birds	Percentage of Hatchability by Years						
		1	2	3	4	5	6	7
White Leghorns	52	87	82					
	32		74	61				
	71		78	71	62			
	30		74	69	62	50		
	24		67	54	63	66	46	
	12		73	62	71	67	71	30
Rhode Island Reds	26	80	83					
	14		82	69				
	15		71	68	74			

* From *Ky. Agr. Exp. Sta. Bul.* 498.

Table 7 8 Effect of dam's age on hatchability of turkey eggs

Source	Breed	Per Cent Hatchability in Breeding Year 1	2	3	4	5
Asmundson and Lloyd (1935)	Bronze	52	51	38	38	19
Marble and Margolf (1936)		57	55 (Same birds both years)			
Scott (1937)	Bronze	73	55			

MANAGEMENT OF FLOCKS

Hatchability is affected by the management of the breeding stock The kind of mating, housing conditions, range, and feeding, all are important in the production of eggs that hatch well

Matings

The ratio of males to females affects fertility The Oregon station has shown that 5 to 6 Leghorn or Cornish males per 100 females and 6 to 7 New Hampshire males per 100 females are sufficient for maximum results Hatcherymen and flock owners who have adopted the Oregon recommendations are pleased with the results

Range

Though flocks can be fed in complete confinement to insure excellent hatchability, it is advisable for both turkey and chicken flocks, which are hatchery supply flocks, to have range where they are exposed to direct sunshine and have access to growing green feed and where the timid males have an opportunity to mate Range conditions, especially if green feed is available, provide insurance against deficient rations which the flock may be receiving The social dominance (peck order) which exists in all flocks prevents the omega (timid) males from mating in confinement, but if range is provided such males may prove more fertile than the alpha (dominant) males and the fertility of the eggs improved by their contribution

Housing Conditions

There is evidence that both extremely cold and extremely hot weather tend to reduce hatchability as well as fertility. Therefore, it behooves the producer of hatching eggs to try to avoid these extremes by a suitable housing program If freezing conditions in the house

can be avoided in winter the flock as well as the caretaker will be benefited If temperatures above 85°F can be avoided in the houses during summer, hatchability is not likely to be reduced as a result of the weather

Feeding

The fertile bird s egg is a complete reproductive unit, containing all nutrients necessary for the development and hatching of its young Everything contained in the egg except the sperm is deposited by the hen The nutrients needed by the hen to produce a satisfactory hatching egg must, of course, be present in the rations the hen consumes Breeder mashes, especially fortified with vitamins necessary for hatchability, should be fed the breeding flock

It should be observed that not only is an adequate and well fortified ration necessary for satisfactory hatchability, but also the vigor of the chicks and their early livability and performance depend upon the vitamins and other nutrients they have stored when hatched (See Fig 7–4)

Proteins, carbohydrates, and fats The laying ration as well as the breeder ration should and does normally contain a variety of proteins carbohydrates, and fats and is adequate for hatchability Thus these nutrients are generally present in such amounts and variety as to insure satisfactory hatching results

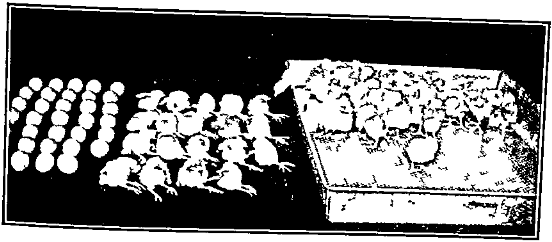
Vitamins The continually expanding list of vitamins contains many which are necessary for hatchability and several which are likely to be deficient and therefore to reduce hatchability

VITAMIN A This vitamin is necessary for satisfactory growth, health, egg production, and hatchability It is supplied by green feed, yellow corn, and the fish oils

VITAMIN D All rations are deficient in this vitamin unless they carry special supplements containing it. Under natural conditions (direct sunshine) birds and other animals are able to manufacture their own vitamin D by the exposure of their bodies to irradiation (ultraviolet rays of the sun) Irradiation of the animal sterols has been developed into the commercial process for supplying most of this vitamin (D_3)

Vitamin D is necessary for mineral metabolism (bone development, etc.), strong egg shells, satisfactory egg production, and hatchability Every laying and breeder mash should contain adequate amounts of this vitamin.

VITAMIN E Deficiencies of this vitamin in poultry rations containing natural grains are rare or non existent It has been shown that a deficiency (created experimentally) of this vitamin does result in early (4–5 days) death of chick embryos by hemorrhages in the circulatory system



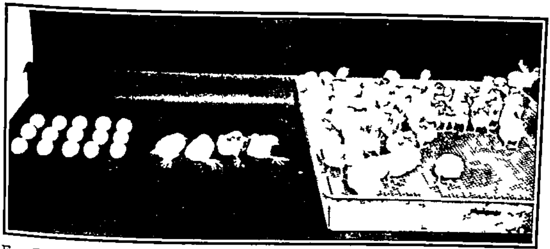


FIG 7–4 The effects of deficient rations for poultry breeding stock are shown in the upper photo From 100 eggs produced by hens receiving inadequately supplemented vegetable protein at a high level 84 failed to hatch and 19 of the chicks hatched died during the first week The lower photo shows the results obtained with a similar diet supplemented with fish meal (Courtesy Bureau of Animal Industry U S D A)

VITAMIN K This vitamin is essential for normal clotting of the blood and chicks hatched from eggs produced by breeders on rations deficient in this vitamin when wing banded may bleed to death The natural source of this vitamin is green feed The fowl can synthesize (produce) this vitamin in its intestinal tract, and microorganisms in poultry droppings create it also

RIBOFLAVIN This vitamin is very necessary for hatchability and is quite likely to be deficient unless the ration is fortified for it The natural sources are green feed, milk products, yeast, and liver However, most commercial breeder rations now contain the pure vitamin (crystalline riboflavin) A deficiency of this vitamin causes curled toe paralysis, anemia, edema, clubbed down, dwarf embryos, and shortened legs and wings Embryonic mortality on rations deficient in

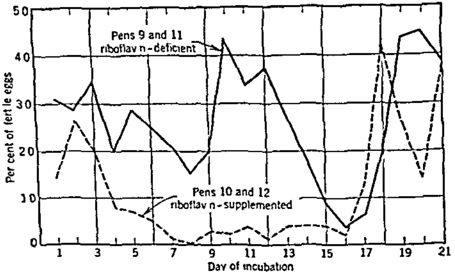


FIG 7–5 Embryonic mortality in eggs produced by hens fed rations containing adequate and inadequate amounts of riboflavin (*Courtesy Calif Agr Exp Sta*)

riboflavin, as shown in Fig 7–5 is particularly high during the second week of incubation

PANTOTHENIC ACID This vitamin is found in most natural feedstuffs (grains and green feeds) and therefore is not likely to be deficient But, if deficient, hatchability will be reduced, and the chicks will develop a dermatitis (cracked skin) condition

BIOTIN Though this vitamin is not likely to be deficient in rations compounded from natural feedstuffs, its deficiency will reduce hatchability, causing embryos to be formed with web feet, shortened and twisted bones, parrot like beaks, and slipped tendons

PYRIDOXIN Wisconsin workers have found this vitamin necessary for both egg production and hatchability, but they point out that it is not likely to be deficient in normal rations

CHOLINE. Though this vitamin is required for normal growth and egg production practical rations need not be supplemented with it, and to do so may cause a decrease in hatchability

NICOTINIC ACID. This vitamin is essential for egg production and hatchability but there is evidence that the chick and turkey embryos can synthesize (produce) it. Whether practical rations need to be supplemented with nicotinic acid (niacin) remains to be determined.

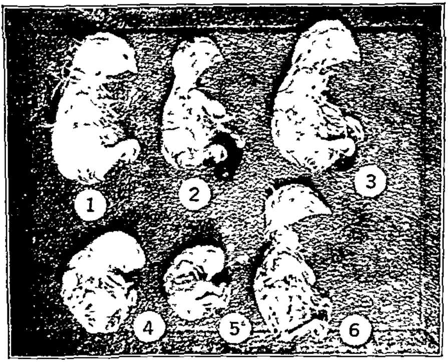


FIG. 7-6 Micromelia (shortening of extremities) in chick embryos caused by manganese deficiency. (Courtesy Ky. Agr. Exp. Sta.)

FOLIC ACID. This vitamin is essential for hatchability. A deficiency of it results in increased embryonic mortality late in the incubation period, delayed hatches, and inferior chicks. However, it has not been determined whether practical breeding rations need to be fortified with this vitamin.

B_{12}. A relatively new vitamin (B_{12}), which was known as the APF, animal protein, and cow-manure factor until the pure vitamin was discovered, is necessary for hatchability. It is found in animal protein supplements commonly used in poultry rations.

Minerals. Many minerals are needed for normal embryonic development, but only a few need be added as special supplements.

CALCIUM. Work at the Kentucky station showed that calcium was essential for hatchability. Evidence also exists, however, that excessive amounts of calcium may decrease hatchability. The best feeding procedure appears to be to give the breeders access to oyster shell or crushed limestone (dolomitic-free).

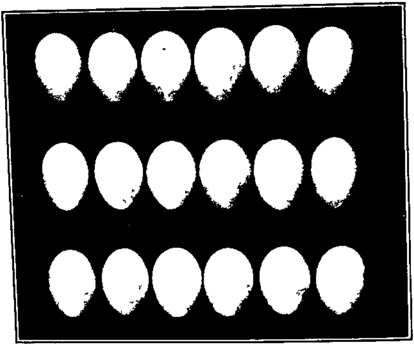


Fig 7–7 Above, eggs which possess desirable physical exterior characters for hatching, below are eggs which should not be used for hatching (Courtesy Mo Agr Exp Sta)

MANGANESE The beneficial effect of manganese on hatchability was first demonstrated at the Kentucky station A deficiency of this mineral results in heavy chick embryo mortality on the twentieth and twenty-first days These embryos show micromelia (short legs and wings) and parrot beaks This micromeliac condition is shown in Fig 7-6

SELENIUM This is a highly toxic substance, which causes heavy embryonic mortality when present in the breeder ration at more than 5 parts per million

SELECTION OF HATCHING EGGS

Certain physical characteristics of eggs are related to hatchability, and, by eliminating eggs that have characters associated with poor hatchability, hatching results can be improved It is also true that these characteristics are inherited and therefore by continued selection may be bred into poultry The more common of these characters are size, color, shape, shell quality, and interior quality as observed by candling (Fig 7-7)

Size of Egg

The size of the egg is related to hatchability, as shown in Fig 7-8 A similar relationship exists in turkey eggs Extremely large and very small eggs do not hatch well It is fortunate that the best eggs for market (23-28 ounces per dozen) also possess high hatchability

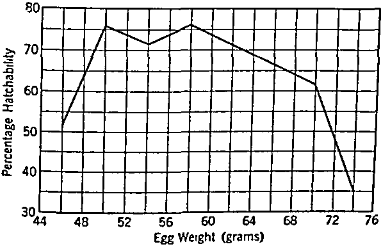


FIG 7-8 Relationship between percentage hatchability and average egg weight per bird, based on the records of 367 hens and of one hatching season (From Godfrey)

Color of Shell

There is evidence from a number of experiment stations that the color of brown-shelled eggs is associated with hatchability, the dark brown eggs hatching better than the lighter brown eggs. (See Table 7-9.)

*Table 7–9 Influence of egg shell color on hatchability of New Hampshire eggs **

Color	Hatchability of Fertile Eggs, %	Hatchability of All Eggs, %
Very light brown	71.1	64.1
Light brown	76.1	66.9
Medium brown	78 9	70 5
Medium dark brown	81.8	76.0
Dark brown	84 1	74.5
Very dark brown	78.6	72.5

* Courtesy C. E Stotts, Ore Agr. Exp. Sta.

Such a relationship does not necessarily exist in all varieties laying brown-shelled eggs, nor does it preclude the breeding of chickens that will lay light brown-shelled eggs which hatch well.

Shape of Egg

Eggs that deviate in shape considerably from normal do not hatch well. However, eggs that are only slightly off shape, ridged, or

*Table 7–10 Percentage infertility and percentage hatchability of various types of defective eggs **

Type of Defective Eggs	Number of Eggs Set †	Percentage of Total Eggs Examined †	Infertile Eggs	Percentage of Eggs Infertile	Number of Chicks Hatched	Percentage Hatch: Fertile Eggs Set	Percentage Hatch: Total Eggs Set
Cracked eggs	610	1 27	155	25 4	242	53 2	39 7
Extra large eggs (65 g or more)	332	0 69	113	34 0	155	70 8	46 7
Small eggs (45 g or less)	155	0 32	80	51 6	60	80 0	38 7
Misshapen eggs	68	0 14	21	30 9	23	48 9	33 8
Poor shells	102	0 21	28	27 5	35	47 3	34 3
Loose air cells	47	0 10	13	27 7	11	32 4	23 4
Misplaced air cells	406	0 85	89	21 9	216	68 1	53 2
Large blood spots	174	0 36	37	21 3	98	71 5	56 3
All defective eggs	1,894	3 95	536	28 3	840	61 8	44 4
Control eggs	3 031		537	17 7	2,174	87 2	71 7

* From National Agricultural Research Center

† The first two columns of figures in table give the numbers and percentages of eggs of various types found among 47 950 newly laid White Leghorn eggs

wrinkled appear to hatch as well as eggs shaped perfectly Table 7–10 shows that eggs definitely misshapen hatched only 33 8 per cent as compared to 71 1 per cent for normal eggs

It should also be noted that the shape of the egg is an inherited character which can be established by breeding

Shell

The quality of the shell is related to hatchability Eggs possessing strong shells hatch best, whereas eggs with thin shells do not generally hatch well The kind of shell deposited on the egg depends upon breeding, nutrition, and weather Some strains or families possess the ability to produce eggs with thick and strong shells, whereas others lay eggs with thinner shells The amount of calcium and vitamin D in the ration affect the shell of the egg Eggs produced in hot weather have weaker or thinner shells than those produced when the weather is cooler Attempts to candle eggs for shell texture and to relate the appearance may be misleading because the mottled appearance of an egg before a candle, which might be interpreted as indicating poor shell texture, is due to the moisture in the shell at that time

Interior Quality as Observed by Candling

Eggs that show inferior market quality by candling do not hatch well Table 7–10 shows that eggs having loose air cells hatched only 23 4 per cent as compared to 71 7 per cent for normal eggs It will also be noted that in this same experiment the percentage of hatch of eggs containing large blood spots was 56 3 per cent or 15 4 per cent below the controls

There is also evidence that eggs which show high quality (show movement of yolks and well centered position of such yolks) when candled before incubation hatch 10 to 15 per cent more chicks than eggs showing a weak or lower quality condition

CARE OF HATCHING EGGS

The hatchability of the best eggs can be destroyed after the eggs are laid and before they are set by improper care during the holding period The important conditions during this period are proper temperature, handling humidity, age of egg, and cleanliness of shell

Temperature

Holding hatching eggs where it is too hot or too cold may result in very poor hatches, or in extreme cases the hatching power of the egg

may be completely destroyed Figure 7–9 shows the relationship of holding temperatures to hatchability of chicken eggs The hatchability of eggs held at freezing temperatures (32°F) begins to decline after the second day, and after 5 or 6 days at such temperatures none of the eggs will hatch Eggs held at zero (air temperature surrounding the egg at 0°F) lose most of their hatching power within 3 or 4

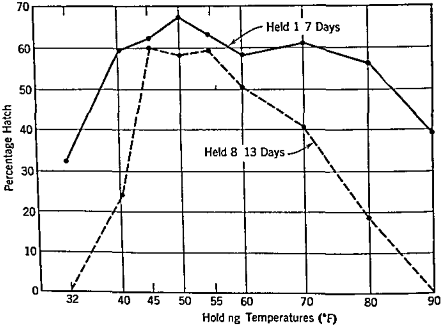


FIG 7–9 Harmful effects of exposing eggs to temperatures below 45°F or above 55°F for periods of over 7 days as compared to those held less than 7 days (Courtesy Mo Agr Exp Sta)

hours Experiments at the Missouri Agricultural Experiment Station showed the following results with eggs held when the air surrounding the eggs was 0°F

	Hatch of all eggs per cent
Eggs held 1 hour	75
2 hours	75 0
3 hours	29 5
4 hours	28 4

Therefore it is most important that hatching eggs be protected in cold weather

Hot weather may be equally as harmful to hatchability as cold weather When the temperature surrounding eggs rises to above 80°F

the embryos develop at a relatively rapid rate, but this development is not normal and many of these embryos are weakened and subsequently die before or after being placed in incubators for normal incubation Work at the Missouri Agricultural Experiment Station showed that the hatchability of eggs held at 90°F for 7 days or longer was completely destroyed

The ideal temperature for holding chicken eggs is near 50°F as indicated by Fig 7–9 A basement or cellar will usually provide satisfactory holding conditions for hatching eggs Where many eggs are held, as in an egg station or in a hatchery, it will be advisable to install refrigeration to provide suitable temperature conditions in hot weather

The importance of proper temperature for holding hatching eggs cannot be overemphasized to the flock owner The commercial hatchery with supply flocks will do well to work with their flock owners on this problem

Handling

Hatching eggs should be cased small end down in new or sturdy cases, flats and fillers, and handled carefully Eggs cased large end down develop many more tremulous air cells than eggs cased with pointed ends down and as shown in Table 7–10 eggs containing loose air cells hatch very poorly Very few eggs cracked by rough handling hatch The more rigid tray packs give better protection to hatching eggs than the regular separate filler and flat packs

If eggs are held longer than 1 week, hatching results will be improved by turning The most practical way to do this is to tilt the case, thereby shifting the position of the egg It should be noted that extensive tests made at the Missouri Agricultural Experiment Station showed that if eggs are held for 7 days or less hatchability was not increased by turning but was slightly depressed by such turning However, it was observed that eggs held for more than 1 week (8–13 days) hatched best if they were turned from the time of laying

Humidity

High humidity where eggs are held tends to prevent evaporation and the enlargement of the air cell This is important in maintaining the market grade of eggs Extensive trials at the Missouri Agricultural Experiment Station showed that high humidity where hatching eggs were held increased hatchability only slightly and improved the observed quality of the chicks somewhat These benefits appeared to be

greater in hot weather The results indicated that high humidity where hatching eggs are held is desirable but that the benefits would *not justify much expense or effort to provide high humidity*

Age of Egg

The length of time an egg can be held without reducing its hatching power depends largely upon the temperature at which it is held Chicken eggs held at 50°F to 60°F retain their hatchability for 1 week, but after that it generally declines gradually to zero after about 4 weeks There is some evidence that eggs set the day laid do not hatch as well as eggs that are 1–4 days old Hatching eggs should be delivered to the hatchery and set at least once each week for best results

Cleanliness of Shell

Clean eggs hatch better than soiled eggs Eggs which have a large part of their surface covered with broken egg material or any other substance that seals the shell will not hatch Such soilage closes the pores of the shell and thereby interferes with the normal movement of air through the shell to the embryo Such soilage is especially harmful if the air cell (large end) of the egg is covered

The question arises as to what one may do with soiled chicken or turkey hatching eggs which are often quite valuable Dry cleaning may be employed but this requires considerable labor Soiled hatching eggs may be washed in warm water or water containing a disinfectant, and the hatchability of such eggs is thereby restored to normal However, if the organism that causes hatching eggs to explode is present serious trouble may be experienced from this condition Table 7–11 shows the results secured at the Missouri Agricultural Ex

Table 7–11 The effect of cleaning soiled eggs on hatchability

Condition	No Eggs Set	Infertile	Dead 2 18 Days	Dead in Shell	Hatch of All Eggs
Clean, unwashed	18,081	7 5	10 7	11 9	69 9
Soiled, washed in a 0.38% Roccal (10% quaternary ammonium compound)	1 215	7 1	12 4	11 3	69 1

Note None of these eggs exploded but the gas-forming (soil borne) organisms that cause explosions may not have been present on the soiled eggs or in the water

periment Station, where all soiled hatching eggs gathered from a flock of 200 New Hampshires from January 21 to August 3, 1948, were washed on the day laid with a quaternary ammonium compound solution at room temperature. These 1,215 eggs were set and incubated with the 18,081 clean eggs from the same flock.

8

Incubation Principles and Practices

The principles and practices necessary for normal embryonic development and hatching must be followed by those who operate incubators and hatcheries successfully. Before discussing these principles and practices, a brief description of the development of a chick during incubation may help explain some of the complex life processes undergone in each of billions of chicken eggs incubated annually.

FERTILIZATION

Fertilization is the union of the sperm and egg that normally occurs in the funnel portion of the oviduct within about 15 minutes after ovulation and therefore 24 hours or longer before the egg is laid. In all higher animal life, fertilization is necessary for normal embryonic development; however, there is evidence of parthenogenesis in birds which initiates some abnormal development. This will be discussed later.

The semen of the male chicken contains from 1 to 10 million sperm per cubic millimeter, and at each normal mating about 1 to 5 billion sperm are ejaculated. Apparently about 100 million sperm are necessary per insemination to produce normal fertility. (Figure 8–1 shows the spermatozoa of the domestic fowl.)

More than 1 sperm (3 to 5 in chickens and 12 to 25 in pigeons) may enter the ovum (egg), but only 1 unites with the female pronucleus to form a zygote (new individual); the others may be active briefly but soon degenerate.

The sperm may travel the length of the active oviduct (about 22 inches) within 26 minutes if no egg is present in the oviduct to prevent their passage. Fertility may occur in eggs laid within 20 hours after a single insemination, but maximum fertility is not reached until

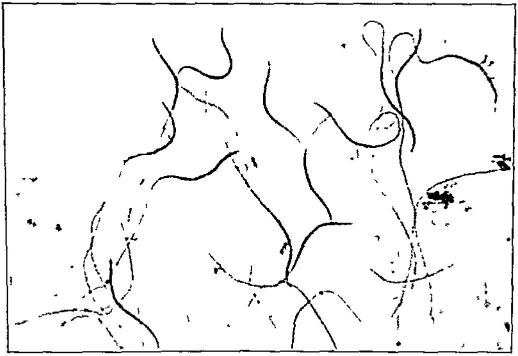


FIG 8–1. Spermatozoa of the domestic fowl (Courtesy Kansas State College.)

the third day. Thereafter, it declines to zero in chickens at about 20 days and in turkeys at about 50 days.

The sperm travel the length of the oviduct by swimming, ciliary action in the oviduct and by peristaltic (muscular) action by the oviduct.

EMBRYONIC DEVELOPMENT

Embryonic Development before Laying

Cell division begins about 3 hours after fertilization or when the egg enters the isthmus region of the oviduct. A second division occurs about 20 minutes later, and within 7 hours the number of cells observed on the surface by Patterson was 152. Since the egg remains in the oviduct and, therefore, at high temperature for 24 hours or longer, the new embryo contains several thousand cells by the time of laying.

The blastoderm of the fertilized egg is sufficiently developed at laying so that it can be distinguished from the infertile germ spot. (See Fig. 8–2.)

Rapid embryonic development proceeds as long as the environmental temperature remains above 80°F. but ceases altogether at temperatures below 70°F. and remains in a quiescent state until the temperature is again raised to above 80°F.

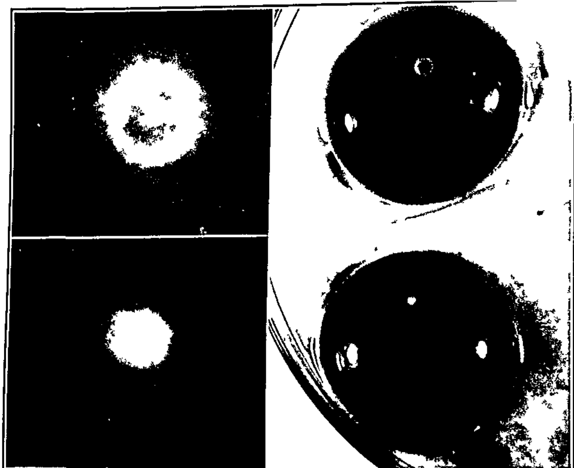


Fig 8-2 Appearance of fertile (left) and infertile (right) eggs at time of laying, enlarged to show differences Note that the blastoderm of the fertile egg is larger and shows a definite circle whereas the infertile germ spot consists of a white spot without a well-defined circle (Courtesy Mo Agr Exp Sta)

Early Embryonic Development

Soon after eggs are placed in incubators, cell division and, thereby, embryonic development proceed as long as a suitable environment is maintained and until the chick is completely developed and hatched.

Since the development of the chick is complex and thorough training in embryology is necessary to understand it, only the simpler and more readily understandable processes that have some practical application in hatchery operations will be discussed in this chapter.

Formation and Development of the Circulatory System

Some system of providing the developing embryo early in its development with nutrients, including oxygen, and of removing waste products is necessary to maintain life. This nature does by establishing circulatory systems (embryonic and extraembryonic) very early in the life of the embryo. By the end of the first day of incubation blood islands make their appearance. They are later joined together and enclosed in tubes or vessels which become parts of the circulatory system. The heart is formed very early in development, and after 29 hours of incubation (allowing 3 hours within the incubator for warming the egg and initiating development) the heart begins to pulsate, feebly. Circulation of blood begins after about 40 hours of incubation. By the third day the heart (still outside the body of the embryo) can be observed (in an opened egg) to beat regularly, and a well-developed extraembryonic circulatory system can be observed with little or no magnification.

EXTRAEMBRYONIC MEMBRANES

In order to nourish and otherwise provide for normal embryonic development nature has created organic structures to supply those needs. Figure 8–3 shows these structures diagrammatically.

Yolk Sac

An extraembryonic membrane grows out from the embryo over the yolk surface until it completely surrounds the yolk and becomes the yolk sac. Yolk material is digested and absorbed by this membrane, and this food material is carried to the embryo by the vitelline veins of the yolk sac. The yolk sac is attached to the intestine, and just

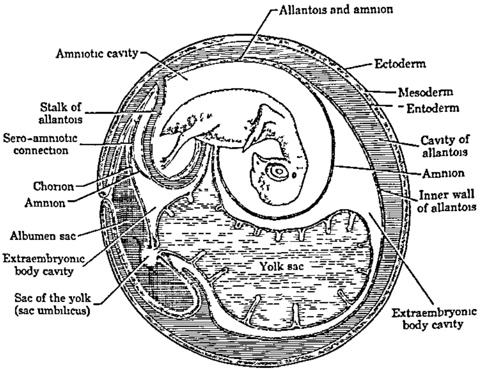


FIG 8–3 Diagram to show chick embryonic development on the twelfth day of incubation From *Development of the Chick*, F R Lillie, revised by L Hamilton, 3rd edition, Henry Holt and Co New York, 1952

before hatching it is drawn into the body cavity About 5 to 6 grams of yolk are drawn into the body and serve as food for the chick for several days

Amnion

The developing embryo of any animal is delicate and needs protection as it develops Nature has provided a structure known as the amnion to protect the embryo against shock, adhesions, and desiccation The amnion envelops the chick embryo and is filled with a fluid in which the embryo floats This fluid prevents drying out and absorbs shock from jarring, etc The walls of the amnion contain muscles which contract rhythmically from the fifth to thirteenth days of chick embryo development, thereby keeping the embryo in motion and minimizing adhesions

Allantois

Nature has provided the allantois to serve as a respiratory and excretory organ, as well as a mechanism for carrying nutrients to the embryo from the albumen and the shell The allantois makes its appearance as an evagination from the hind gut on the third day of incubation It continues to develop until by the twelfth day it surrounds all the contents of the egg enclosed within the shell membranes The circulatory system of the allantois supplies the embryo with oxygen and eliminates carbon dioxide It absorbs the albumen and delivers its nutrients to the embryo It also comes in contact with the shell and absorbs calcium therefrom for the embryo

The allantois serves as an excretory organ for the kidneys, and uric acid and urates are deposited in the allantoic cavity and at hatching are left within the shell as waste products

Preparation and Development for Hatching

Between the twelfth and the sixteenth day of chick development the embryo orients itself so that the head is near the air cell Previous to that time, if the large end of an egg is held toward the left of the observer the head would usually be pointed away from the observer As hatching time approaches the head assumes a natural position for pipping the shell which is ordinarily turned to the right and under the right wing There are many abnormal or malpositions which embryos take and from which they have difficulty in hatching (See Table 8–1)

By the nineteenth day the intestine is enclosed within the body cavity and the yolk sac begins to enter the body cavity By the twentieth day the yolk is completely enclosed within the body walls, the amniotic fluid has disappeared, and more blood is passing through the lungs By this time some chicks have pierced the air cell, have begun to breathe air through their lungs, and are able to peep sometime before breaking the shell The allantois continues to function as a respiratory organ until the chick pips the shell

The chick is equipped with two special structures for pipping the shell: an 'egg tooth on the upper beak for chipping away the shell and special muscles on the back of the neck for thrusting the head and beak upwards and breaking the shell If proper incubation conditions have prevailed the chick should be developed and hatched by the end of the twenty-first day

Table 8 1 Classification of embryo positions

(After Asmundson)

A Head in large end of egg
   1 Head turned right and beak under right wing
   2 Head turned right but beak not under right wing
   3 Head turned right but away from air space
      (a) beak under wing
      (b) beak not under wing
   4 Head buried between thighs
   5 Head turned left and beak under left wing
   6 Head turned left but beak not under left wing
   7 Feet over head (resting on head)
      (a) beak under right wing
      (b) beak not under right wing but turned right
      (c) beak under left wing
      (d) beak not under left wing but turned left

B Head in small end of egg
   1 Head turned right and beak under right wing
   2 Head turned right but beak not under right wing
   3 Head buried between thighs
   4 Head turned left and beak under left wing
   5 Head turned left but beak not under left wing
   6 Feet over head (resting on head)
      (a) beak under right wing
      (b) beak turned right but not under right wing
      (c) beak under left wing
      (d) beak turned left but not under left wing

Development of the Organs of Reproduction

Because sexing by the appearance of the gonads (ovary or testes) and the accessory organs is of much practical importance in hatchery operations a brief description of their development follows

The gonads arise from indifferent germinal epithelium which can be distinguished microscopically at about the ninety sixth hour stage The sex of the chick can be determined after about 156 hours of incubation by the relative sizes of the male and female gonads, and by the presence of more primordial germ cells in the germinal epithelium of the female The right gonad (ovary) of the female does not develop as rapidly as the left ovary and thus becomes rudimentary This right ovary is potentially capable from 21 to 40 days after hatching of developing into a testis and may do so if the left ovary is destroyed or removed and the inhibitory effect of the female hormone thereby removed

The left testis up to the eleventh day of embryonic development is capable of developing into either a testis or ovary.

Left and right oviducts are laid down in both the male and female in the early stages of development and up to the eighth day cannot be differentiated. Beginning about the eighth day, these ducts retrogress in the male and by about the eighteenth day have disappeared. Normally, the right oviduct of the female ceases development after the eighth day and degenerates into a short rudimentary oviduct attached to the cloaca.

The testes of the male and the left ovary of the female continue to develop. By hatching time it is believed all ova (eggs) that will be produced by the female are present.

In the cloacal region a pronounced genital eminence develops in the male, but in the female there is very little development of this organ. Chick sexors must learn to distinguish the many different types in order to sex accurately. (See Fig. 8–4.)

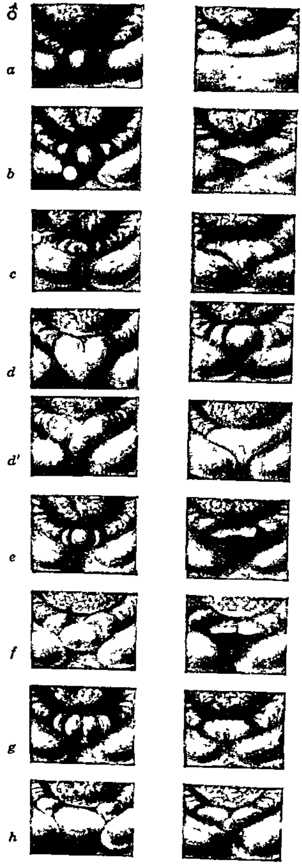


FIG 8–4 Chick sexing Diagrams of the everted cloacas of chicks showing the different structures observed in male chicks (left) and female chicks (right).

SEXING BABY CHICKS

Chick sexing has been practiced in the United States for over 20 years having been first demonstrated by Japanese sexors in this country in 1933 More than one third of all chicks sold are now sexed and the practice seems to be increasing in favor particularly since the strictly egg production breeds have been gaining in popularity on farms at the expense of the dual purpose breeds The sex of day old chicks can be determined readily by several different methods thus permitting the customer to buy all pullet chicks or all cockerel chicks as desired

The method most commonly employed today is the original Japanese method of vent examination This method requires considerable practice for proficiency The sexor everts the vent of the chick and locates the eminence of the copulatory organ typical of the male chick or the folds at the edge of the everted vent opening which characterize the female chick.

Another method less frequently used, is the separation of the sexes by the down color which is possible in certain crosses and in auto-sexing varieties such as the Cambar Some use the examination of the wing feathers of day-old chicks to determine sex This is possible if rapid feathering males such as White Leghorns are mated to slow feathering females

A new method which has attracted considerable attention is the chick sexing machine A specially constructed instrument with a light on the end is inserted into the vent of the chick. The sexor can see the male or female organ by looking through the magnifying lens of the sexing instrument.

Sexing by Vent Examination

There are a dozen or more organizations in the United States which offer the services of expert trained sexors These organizations will contract to supply trained personnel for the hatching season at a stated price per chick or per 100 chicks This price will usually average about 1 cent per chick It may be slightly more or less depending on the volume of chicks to be sexed Practically all these sexors employ the Japanese method of vent examination

A good strong light is essential for sexing by the vent method successfully A 200-watt blue bulb is generally used with a reflector as shown in Fig. 8–5 This type of light reveals the essential anatomy

for chick sexing much better than other types of artificial light The sexor works out of the "as hatched or straight run chicks, and has a box on each side, one for the pullet chicks and one for the cockerel chicks As the boxes of sexed chicks are filled, the sexor places a sticker on the end of each, which identifies it as pullets or cockerels A can is used by sexors to hold the fecal material squeezed from each

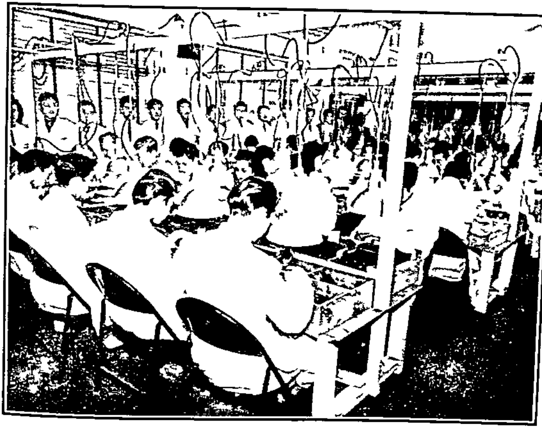


Fig 8–5 Teaching chick sexing (Courtesy American Chick Sexing Association)

chick before the vent is everted for examination A good sexor can easily sex 700 to 800 chicks per hour, and the faster sexors can sex 1,000 or more chicks per hour

It is a general practice to guarantee 95 to 97 per cent sexing accuracy The sexing contract of one firm states

> The first party hereby guarantees that the sexor or sexors furnished to the second party will have the efficiency of at least 97% as to determining the sex of baby chicks For any inaccuracy below 97% the first party will reimburse the second party at the rate of the difference between the second party's current cockerel and pullet prices upon proper proof of the claim made within sixty (60) days of the alleged inaccuracy

Shrader, Burrows, and Hammond, describing chick sexing by the vent method, state

> Chick sexing may be tedious, but it is not difficult to learn Generally speaking the heavier breeds have larger copulatory organs than the lighter weight breeds Likewise the dark colored breeds show considerable color in the organs, whereas the light colored (white) breeds have very pale organs
>
> Remember to evert the vent sufficiently to obtain a clear view of the region in which the organ is located
>
> First judge from the size and prominence of the organ whether the chick is a male or a female If there is any doubt, apply the following criteria In the case of the male, the organ should have a tendency to stand up, be waxy in appearance, or should resist flattening or stretching, if the chick is a female, the organ if present, should be very small, indistinct as to boundary lines flabby or disappear upon stretching
>
> If your accuracy seems to have taken a slump, check up on the following Is your light good? Have you just changed your lighting arrangement? If so, are you using a clear bulb? Are your chicks too soft? Are they too old? Are the chicks weak or poorly hatched?
>
> Even after considerable practice it often helps greatly to kill and check the first few doubtful chicks encountered This inspires confidence, which is a big factor in rapid and accurate sexing

If a considerable volume of chicks is to be sexed, it is probably preferable to arrange with some sexing organization to furnish a trained sexor or sexors for the hatchery If relatively few chicks are to be sexed and there is difficulty meeting train schedules, etc, it may be desirable to have an employee or some member of the family attend sexing school and learn the technique of sexing Smaller hatcheries may find the use of sexing machines such as are now offered helpful in meeting the demand for sexed chicks

Sexing by Color of Down

In recent years there has been some interest in the development of breeds and crosses that can be sexed without using the Japanese method of vent examination

Chicks from the "gold" × "silver" type of cross can be identified at hatching time by the down color In this cross a "gold" type male such as the Rhode Island Red, Red or Buff Cornish is mated to the "silver" type female such as the White Wyandotte, Delaware, or Dominant White female The female chicks from the gold × silver cross are buff or red color, and the males are white or creamy colored with some smokiness in the down color Both sexes may show some narrow

striping The adult progeny of this cross are Columbian color pattern males and buff or red females

The "black pullet" popular in the eastern United States can be identified at hatching by down color In this cross, production-bred Rhode Island Red males are mated to Barred Rock females The pullet chicks are solid black over the head and back, with black shanks The cockerel chicks have a white spot on the head and have yellow shanks

Jaap (1946) describes the "wing spot" method for color-sexing Rhode Island Red and New Hampshire chicks This method has proved 90 to 95 per cent accurate In this method the sexor looks down on the back of the chick with its wings outspread The male chick will have a white spot about in the middle part of the wing This white spot may vary in size from a short blaze along the muscle outline of the chick's forearm to an extremely large white spot which may cover the entire web and extend along the wing front In contrast, the web region of the baby pullet's wing is always uniformly red and about the color tone of its head and back Greater accuracy can be obtained in this method by selecting as breeders males that have shown the large white spot on the wing at hatching time and females that were red winged as chicks

Purebred Barred Rocks can be sexed with some accuracy at hatching time by examining the appearance of the head spot and the shank coloring Male chicks have a spot that tends to be diffused and circular in outline and is not clean cut The head spots of the females are generally irregular in shape but stand out as clear white in contrast to the surrounding black The shank color of the females is usually a combination of dark and light color Male chicks have shanks of uniformly lighter shade without contrasting color areas

Chick Sexing Machines

One of the first demonstrations of a chick sexing machine in the United States was at the San Francisco convention of the American Poultry and Hatchery Federation in 1952 Chick sexing machines apparently enable the sexor to attain as high as 99 to 100 per cent accuracy after approximately 50 or more hours of practice Some of the advantages of the chick sexing machine are (1) The high degree of sexing accuracy gets 3 to 5 per cent more pullets into the pullet boxes If pullets are selling at 35 to 40 cents each, this would amount to a substantial saving on a volume of chicks (2) Help working at regular hourly rates in the hatchery can be trained to do this sexing job

with the machine, thus lowering the cost per chick sexed The disadvantage at present seems to be that it is too slow for use in a hatchery producing a big volume of chicks and there may be some danger of injuring the chick, particularly by sexors who have not yet become adept at operating the chick sexing "machine" or instrument.

There are at present two machines on the market, one manufactured in Japan and one in England The cost of the machines is approximately

Fig 8–6 Using chick sexing machines to sex chicks (Courtesy American Chick Sexing Association)

mately $400, and one concern is charging an additional $50 training fee With these machines, the sex organ, approximately 3 mm in size, is magnified 3 to 5 times through the optical lens of the sexing instrument. (See Fig 8–6)

For small hatcheries desiring to do their own sexing, the chick sexing machine should have considerable merit When speeds of 700 or more chicks per hour can be attained with 100 per cent accuracy, these machines may have general acceptance in the industry

TEMPERATURE IN INCUBATION

Temperature is most important in incubation Incorrect temperatures are the cause of more poor hatches than any other physical environmental factor

Temperature Necessary to Initiate Embryonic Development

Species of birds vary in their temperature requirements, with some wild species developing and hatching at temperatures of 85°–90°F. The eggs of the Ruddy Duck can, after a few days of incubation, proceed to hatch with little or no external heat.

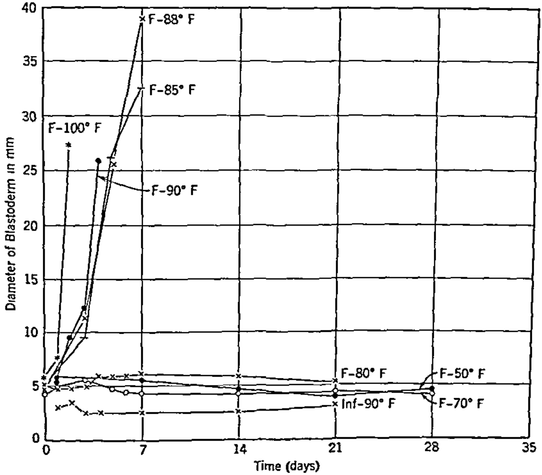


FIG. 8–7 Relation of temperature and embryonic development in chicken eggs (Courtesy Mo. Agr. Exp. Sta.)

In the case of chicken eggs there is very little embryonic development until the temperature reaches 80°–85°F. Figure 8–7 shows the results of an experiment conducted at the Missouri Agricultural Experiment Station in which very rapid embryonic development occurred at 85°F., but little development occurred at 80°F.

Correct Temperature

The correct temperature for incubating chicken and turkey eggs under given artificial conditions can vary but little from an optimum

for best results Until the operator learns more desirable temperatures, the manufacturer's instructions for modern incubators should be followed very closely and the variation kept within 1 degree or less Experienced operators can cite situations where the temperature has varied several degrees and the hatch has been satisfactory Such varia-

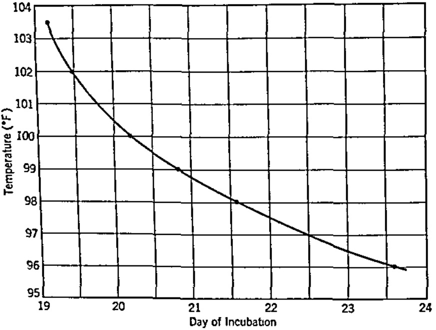


FIG 8–8 Effect of incubation temperature on the time of hatching chicken eggs (Barott, 1937)

tion has generally been of short duration and frequently the interior egg temperature did not rise or fall to the air temperature surrounding the eggs (See Fig 8–8)

The modern forced draft incubator should be operated between 99°F and 100°F for the first 18 days and may be operated at the same temperature or 2 or 3 degrees lower during the last 3 days of incubation

HUMIDITY DURING INCUBATION

Humidity is measured by comparing wet and dry bulb thermometer readings so as to arrive at the relative humidity of the atmosphere When the relative humidity of the air is 70 per cent, the air is carrying 70 per cent of the moisture it is capable of carrying at that temperature Warm air carries more moisture than colder air A dry atmosphere causes increased evaporation from the wick surrounding the

bulb of a thermometer and thereby lowers the temperature more than a damp or more nearly saturated air would do. Table 8–2 shows the relative humidity readings when the wet and dry bulb thermometer temperatures are as indicated.

Table 8–2 *Relative humidity as determined by differences in wet bulb and dry bulb thermometer readings* *

Dry Bulb Reading (degrees F.)	Degrees F. Wet Bulb Is Below Dry Bulb Temperature							
	1.8	3.6	5.4	7.2	9.0	10.8	12.6	14.4
95.0	94	87	81	75	69	64	59	54
96.8	94	87	81	75	70	64	59	54
98.6	94	87	82	76	70	65	60	55
100.4	94	88	82	76	71	66	61	56
102.2	94	88	82	77	71	66	61	57

* Adapted from 22nd edition of Hodgman's *Handbook of Chemistry and Physics* 1937. Chemical Rubber Co., Cleveland, Ohio.

The moisture content of the air surrounding eggs during incubation must be kept within relatively wide limits (50 to 60 per cent R.H.) during incubation. However, there are optimum humidity conditions for most successful hatching (near 70 per cent R.H.).

Effect of Humidity on Embryonic Development

The calcium metabolism of the embryo is affected by the humidity prevailing during incubation. When humidity is relatively high, more calcium is transferred from the shell to the bones of the developing embryo than when the air surrounding the egg is relatively dry. (See Fig. 8–9.)

Embryonic growth is retarded by both high and low humidity. Optimum growth is obtained when the relative humidity is near 60 per cent. Barott (1937) found that the energy metabolism (an indication of growth) of the embryo was higher when the relative humidity was 60 per cent than at 70, 84, 42, or 24 per cent.

The amount of water evaporated from the eggs during incubation is very closely correlated with the relative humidity of the incubator (see Fig. 8–10).

Barott reported that variation in relative humidity during incubation did not influence the total time required for embryonic development and hatching. Townsley, however, found that with Smith incubators there was an effect and that high humidity, as compared to lower humidity, shortened the incubation period.

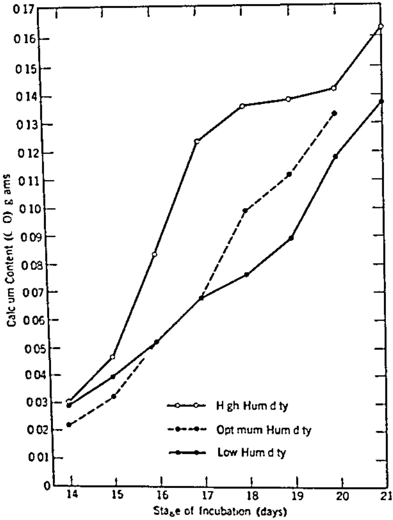


Fig. 8.9. The effect of relative humidity on the calcium content of the embryo. (After Romanoff.)

Recommendations for Humidity

Extremes in humidity during incubation should be avoided. For chicken eggs 60 per cent relative humidity for the first 18 days and 70 per cent thereafter is recommended. For turkey eggs the corresponding humidities should be 2 or 3 per cent higher. This means operating the incubators during the first 18 days with the dry bulb thermometer reading 99° F. to 100° F., depending upon the incubator manufacturer's instructions, and the wet bulb thermometer reading 87° F. to 88° F. From the eighteenth day to hatching the wet bulb thermometer should read 90° F. and may go even higher when hatching begins. There is

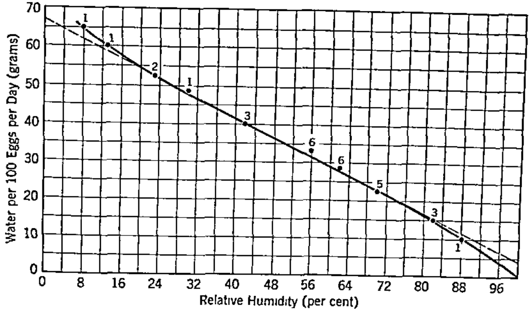


Fig 8–10 Water elimination of incubating eggs at various humidities during the first week of incubation The numbers on the curve indicate number of experiments, for each of which there were 21 observations (From Barott)

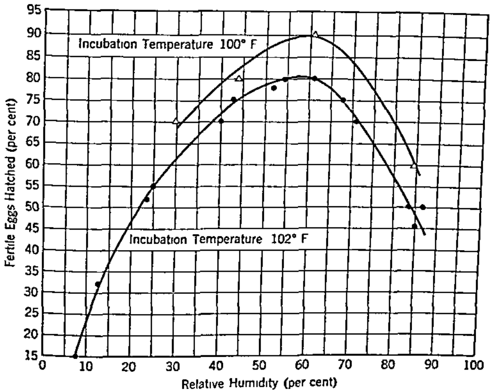


Fig 8–11 Effect of relative humidity during incubation on hatchability, oxygen 21 per cent and carbon dioxide below 0 5 per cent (Barott, 1937)

some evidence that at high altitudes a wet bulb reading of 90°F, when the dry bulb temperature is 99°F to 100°F, at hatching time improves hatching results The humidity of the hatching compartment should be raised before the eggs begin to pip to avoid chicks sticking in the shell (See Fig 8-11)

VENTILATION DURING INCUBATION

The chick embryo requires oxygen and gives off carbon dioxide during development Unless these gases are kept within certain limits high embryonic mortality and poor hatches will result. If more than 50 per cent of the egg shell is sealed (made impervious to air) embryonic development is affected and hatchability is reduced If the atmosphere of the incubator contains more than 1 per cent of carbon dioxide, embryonic mortality is increased and at 5 per cent all embryos die before hatching There is some evidence that 0.5 per cent to 0 8 per cent of carbon dioxide in an incubator is desirable for most satisfactory development and hatching.

Oxygen Requirements

All living animals require oxygen for normal development This must be supplied in a normal atmosphere containing about 21 per cent

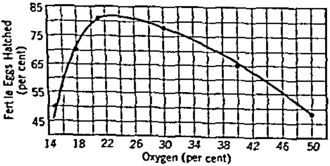


FIG. 8-12 Effect of oxygen during incubation on percentage of fertile eggs hatched (temperature 99°F relative humidity 70 per cent carbon dioxide below 0 5 per cent) (From Barott.)

of oxygen Barott showed that increasing oxygen above 21 per cent resulted in a decrease in hatch of about 1 per cent for each per cent increase in oxygen whereas when oxygen was decreased below 21 per cent the hatch was reduced by 5 per cent for each per cent the oxygen content of the air was lowered (See Fig 8-12.)

Effect of Atmospheric Pressure on Hatching Results

Fraps (1945) observed that hatchability was not reduced until the pressure simulated an altitude of 87,000 feet or higher (See Table 8-3)

Table 8-3 Effect of atmospheric pressure on hatchability and loss of water

(After Fraps)

Pressure, in mercury *	Corresponding Altitude, ft	Per Cent Hatch of Fertile Eggs	Loss of Water, %
29 9	200	83-92	0 22 0 42
23 6	6,500	80	0 48
16 2	16,000	87	0 51
6 9	35,000	92	
5 9	39,000	86	0 38
4 4	45,000	83	0 32
0 9	78,000	90	0 71
0 6	87,000	80	2 63
0 5	90,000	45	7 57

* Eggs subjected to indicated pressure 12 hours daily for 3 days

POSITION AND TURNING DURING INCUBATION

The correct position of the egg and proper turning while eggs are being incubated is necessary for most satisfactory hatching results

In modern incubators eggs are trayed small end down and turned by tilting the trays at different angles Until recently very little research had been conducted to determine the correct angle for tilting the egg trays Results secured at the Missouri Agricultural Experiment Station (see Table 8-4) indicate that tilting the egg trays 45° and thereby turning the eggs 45° in two directions from the perpendicular, or a total of 90°, apparently gives best results The Missouri station has also investigated the value of multiple plane turning, that is, turning the eggs through more than one plane and thereby incubating the eggs in more than the customary two positions Table 8-5 shows the Missouri results and indicates that the position of the egg during incubation has a pronounced effect on hatching Eggs incubated with the large end (air cell) down do not hatch well because many of the chicks develop with their head in the small end of the egg, a malposition from which few hatch The angle at which eggs are incubated affects the development of other abnormalities, eggs turned 45° while being incubated develop more embryos with head between the thighs and

Table 8–4 The effect of the angle of turning eggs during incubation on hatchability *

Date Set	Angle Turned	Eggs Set	Infertile	D_1	D_2	D_3	Chicks Hatched	% Hatch All Eggs	% Hatch Fertile Eggs
9-11-52	20°	702	108	12	106	106	370	52 71	62 29
	30°	702	109	17	82	75	419	59 69	70 66
	45°	702	121	16	57	37	471	67 09	81 07
9-18-52	20°	693	82	13	97	97	404	58 30	66 12
	30°	693	81	10	76	53	473	68 25	77 29
	45°	694	71	10	55	30	528	76 08	84 75
10-2-52	20°	655	76	9	114	88	412	58 94	66 13
	30°	695	83	7	62	54	493	70 53	80 03
	45°	698	66	18	59	25	530	75 93	83 86
10-9-52	20°	707	58	5	46	67	531	75 11	81 82
	30°	707	56	11	35	40	565	79 92	86 79
	45°	706	42	15	41	23	585	82 86	88 10
Grand Total	20°	2 801	324	39	363	358	1 717	61 30	69 32
	30°	2 801	329	45	255	222	1 950	69 62	78 88
	45°	2 800	300	59	212	115	2 114	75 50	84 56

* Delaware × New Hampshire Eggs from the W B Smith Hatchery Columbia Mo From *Mo Agr Exp Sta Bul* 599

beak over wing than eggs incubated in horizontal position whereas eggs incubated in a horizontal position develop more embryos with head in small end and head turned away from the air cell

Turning

The method of turning as well as frequency of turning have an effect on hatching Some hold that slow or gentle turning may have a detrimental effect on hatchability and that the eggs should be shifted from position to position rather rapidly There are no available experimental results to answer this question

Experiments conducted to date indicate that frequent turning gives best results Though eggs may be turned as often as every 15 minutes there is no experimental evidence to justify turning more often than every 3 hours Table 8–6 shows the results obtained at the Kentucky station when eggs were turned up to 8 times daily Frequent turning may be necessary to overcome faulty control of temperature and ventilation

Turning should be continued until the eighteenth day with chicken eggs and until the twenty fourth day with turkey eggs

Table 8–5 The effect on hatchability of incubating eggs in 4 and 6 positions as compared to 2 positions *

Date Set	No Positions	Eggs Set	Percentage Hatch of All Eggs	Difference	Percentage Hatch of Fertile Eggs	Difference
3 9 52	2	420	80.5		81.5	
	4	420	85.0	+5.0	86.7	+5.2
	6	420	86.9	+6.9	87.3	+5.8
4 15 52	2	414	73.0		79.3	
	4	420	74.8	+1.8	85.1	+5.8
	6	420	77.4	+4.4	85.8	+6.5
5 7 52	2	414	72.2		82.6	
	4	336	78.3	+6.1	89.5	+6.9
	6	420	75.7	+3.5	87.6	+5.0
5 26 52	2	409	68.9		82.5	
	4	336	71.4	+2.5	86.3	+3.8
	6	420	74.3	+5.4	89.1	+6.6
Total	2	1,657	73.7		81.4	
	4	1,512	77.7	+4.0	86.8	+5.4
	6	1,680	78.6	+4.9	87.4	+6.0

* The eggs were tilted 6 times daily in the trays and the trays were tilted from side to side every hour

The eggs incubated in 2 positions were turned 30° (total of 60°) The eggs incubated in 4 and 6 positions were tilted 40° from the perpendicular in opposite directions and also turned 30° White Leghorn eggs produced on the university poultry farm From *Mo Agr Exp Sta Res Bul* 502

Table 8 6 Effect of frequency of turning hens eggs in a forced-draft incubator

(Insko and Martin 1933)

Breed	Times Turned Daily	Total Eggs	Per Cent Fertility	Per Cent Total Eggs Hatched	Per Cent Fertile Eggs Hatched
White Leghorn	2	1,032	87.1	58.7	67.4
	4	1,004	88.0	62.0	70.4
	6	994	86.2	63.6	73.7
	8	968	85.2	66.5	78.1

The development of a chick or poult during incubation is a complex biological process influenced by a multitude of factors, several of which have been discussed in Chapters 7 and 8

The success or failure of a hatchery depends upon how well the factors that influence fertility and hatchability are controlled

9

Securing Hatching Eggs

Hatching eggs are the raw material from which the hatchery produces the finished product, the baby chick.

A good hatching egg supply is one of the first essentials of a successful hatchery This is a point often overlooked in establishing a hatchery in a new territory Elaborate hatchery buildings with the finest equipment have been built and failed because the owner discovered, too late, that the territory would not support a program for hatching egg supply flocks If supply flocks are set up at distant points, shipping costs may be too high for profitable operation

The hatching egg supply must be dependable and of good quality A good supply source delivers eggs in quantity in the months when the hatchery needs them Such eggs are produced under a program that gives a high percentage hatch of salable chicks

The egg supply must be backed by a program of flock improvement and pullorum testing if the hatchery is to hold the customers obtained through its sales program

SOURCES OF SUPPLY

Production of Own Eggs

The ideal supply program from the standpoint of quality control is one where the hatcheryman owns and manages the flock from which he obtains hatching eggs Under this system, the hatcheryman has full control of the breeding and management necessary to give good hatches of quality chicks

This system also has some disadvantages If the hatcheryman must hire the breeding flock cared for, it is often difficult to find persons who can care for and manage large laying flocks successfully

The breeder hatchery program also requires the hatcheryman to divide his time between the rearing of replacement pullets the production of eggs, the management of the hatchery, and the sale of chicks

Such wide diversification of efforts often results in too little attention to the details necessary for success

Perhaps a modification of this program, whereby the hatchery owns one large breeder flock from which it makes its own replacements and those of cooperating farms, so that all chicks produced are of the same breeding, would fit into most hatchery programs better This would maintain quality, divide the investment and risk, and permit larger volume distribution of quality breeding

Flock Owners

The farm flock owner is the basis of the vast majority of hatching egg supply programs that we now have The flock owner owns his birds, buildings, and equipment He gets his chicks from special flock replacement stock from the hatchery to which he sells, and produces hatching eggs which are sold at a premium usually over the current or graded market price

Hatching egg supply flocks may be relatively small, as few as 100 hens per flock, or very large, numbering several thousand birds per flock Most hatcheries prefer that flocks be reasonably large, numbering 300 hens or more Larger flocks are more economical for the hatchery to service in culling and bloodtesting and they help to give more uniform quality For example, it is much cheaper for the hatchery to handle 100 flocks of 300 hens each than 300 flocks of 100 hens each Each would give the same number of hens, but the 300 flocks would mean many extra miles of driving and time lost in setting up and loading the coops, testing tables, and other equipment used in testing

However, many midwestern hatcheries have not been so eager for large flocks of 1,000 hens or more in recent years They have found that 1,000 or more hens are often too many for the average farmer to properly care for If sickness hits the 1,000 hen flock, it means a big loss to the flock owner in income, and to the hatcheryman in eggs Large flocks are also most often solicited by various salesmen and egg buyers, and as a result it is more difficult to keep flock owners satisfied with the hatching egg program

Flock owners should be chosen who are good managers They should not be promised too much at the start in the way of premiums, length of buying season, or in profits they may expect Such promises are sometimes impossible to fulfill, and this leads to general dissatisfaction with the hatching egg program

Egg Stations

Many hatcheries with large volume production of baby chicks find it necessary to set up egg buying stations at distant points in order to get enough volume to fill their capacity These egg buying stations represent the hatchery in their territory They may have men qualified to cull and bloodtest, or the hatchery may do the culling and testing to qualify the flocks for selling hatching eggs It is highly preferable for the hatchery to do its own culling and bloodtesting than to depend on station men at some distant point to do this work It is difficult to get egg station men to realize the importance of all the steps necessary to produce a quality chick Therefore they best serve as a delivery point for the hatching eggs of the hatchery flock owner

The hatchery should have a clearly stated legal contract with the egg station to assure delivery of all hatching eggs purchased

Egg Brokers

Hatching egg brokers are persons who engage in the business of locating supply flocks, buying the eggs from them, and reselling the eggs to a hatchery at a margin of profit for handling The quality of such eggs is dependent on the broker's knowledge and interest in seeking egg sources producing the kind of eggs that the hatchery needs, whether for egg laying flocks or for broiler chicks

Hatching Egg Dealers

Hatching egg dealers do all the work of lining up replacing blood testing and culling the flocks that the hatchery does They then sell the eggs produced from the supply flocks The hatching egg dealer who has been established in business for years should be a reliable egg source He must service the flocks and pay a premium for the eggs, so that the flock owner will continue to do business and be satisfied The hatching egg dealer must charge a sufficient amount above the price paid the flock owner to cover flock improvement expense and return a profit for labor and investment

Other Hatcheries

Some hatcheries get their egg supply from other hatcheries This has both advantages and disadvantages If the hatchery supplying eggs is small, and has considerably more flocks than needed for its own capacity, it may prove a satisfactory source of eggs However, hatcheries frequently wish to sell all their surplus eggs when eggs

are surplus and to keep all their eggs when eggs are scarce and the demand for chicks is good. Hatcheries usually keep their best hatching eggs, those that hatch best and from their best flocks, for their own use and sell the others. Although this may appear to be a logical procedure to the seller, it frequently works a hardship on the hatchery that receives the eggs.

When buying eggs from another hatchery, it is desirable to work out an agreement in advance of the hatching season regarding the flocks from which eggs are to be shipped, with the understanding that those particular eggs are to be set aside for shipment each week regardless of scarcity or surpluses.

SECURING FLOCKS

A program for securing hatching egg flocks must have as its basis sound reasons why the production of hatching eggs is profitable to the flock owner.

The flock owner is interested in the premium over market price paid for hatching eggs, the length of the buying season, and the costs connected with maintaining a flock for the production of hatching eggs.

Direct Solicitation

The hatcheryman can most quickly secure flocks by a systematic program of direct flock solicitation. In areas where there are a good many commercial or farm egg flocks, it is a relatively easy matter to drive through the country and seek out those farms that show by their buildings and improvements that they handle chickens for profitable production. Many of these people have obtained stock of excellent breeding because they have found such stock most profitable. Such farms are usually interested in the extra profits they can obtain by selling hatching eggs.

Some of the benefits of the hatching egg program to the flock owner are as follows:

1. *Extra, Direct Profits.* The bonus, or premium, paid by the hatchery over prevailing market price represents a net profit which makes a substantial contribution to the total income of the flock. One group of flock owners found that their extra profits on hatching eggs ranged from 43 to 50 cents per bird after deductions for the cost of cockerels, bloodtesting, etc.

2 *High Egg Production throughout the Year* Flock owners are supplied with chicks of the very best breeding by the hatchery Their flocks are culled and bloodtested and the non laying hens are removed from the flock The hatchery also insists on a good feeding and management program All these features are conducive to high flock production

3 The flock owner contributes to a better poultry industry The flock owner whose care and attention ability and intelligence produce good hatching eggs contributes to the success of other poultry raisers Good flock owners are essential to a successful poultry industry

Local Ads and Local Mailings

Advertisements in local papers and local box holder mailings in the territory surrounding the hatchery can be helpful in making new contacts and locating new prospects who may be interested in selling hatching eggs Such advertisements and mailings can stress the extra income from the sale of hatching eggs and the flock improvement and extra egg production from owning a hatchery supply flock Some hatcheries have used radio as a medium to reach prospective flock owners

Established Egg Dealers

In most communities there are egg poultry or feed dealers who have been in business for years in the territory and know the location and names of most of the good poultry raisers These people can be very helpful in locating flock owner prospects who are interested in selling hatching eggs The hatchery can work through established dealers employing the same methods of direct solicitation advertising and local mailings to locate prospective flock owners

OBJECTIVES OF A FLOCK PROGRAM

The secret of a good flock program is to have or cultivate flock owners who follow good poultry management practices and pursue a systematic policy of flock replacement to give the flock owner chicks of the finest breeding at all times No amount of culling bloodtesting and service work can overcome a haphazard replacement program which perhaps may give the flock owner good chicks at one time and poor chicks another time

The three factors that seem to influence flock owners to continue to sell hatching eggs, more than any others, are (1) length of buying season, (2) flock service, and (3) premium for eggs

The hatchery program should have as its objective the above three points, with a view to giving the flock owner as long a season as possible for his eggs, flock service that will make for better management and more profit for the flock owner, and a premium for good hatching eggs which will give a profit to the flock owner above the extra costs of maintaining a hatchery supply flock

Establishing a Basis for Buying Hatching Eggs

The price the flock owner receives for hatching eggs is influenced by the current price of market eggs and the hatching egg premium, which is usually based on the costs to the flock owner in meeting the hatchery's requirements The local competitive situation in territories where several hatcheries operate may be the biggest factor in setting the premium for hatching egg purchases

Some hatcheries base their egg premium on the breeding of the males in the flock If pedigreed males are purchased by the flock owner at an added cost, the flock owner is entitled to more for his hatching eggs than someone who has not had this extra cost

In recent years, there has been a trend in the Middle West and South toward payment of hatching egg premiums on the basis of flock size and management practices For example, one hatchery gives an extra 3 cents per dozen eggs above the regular premium to flock owners who have 350 or more hens, hatch their chicks before April 1, and rear their pullets in range shelters on clean ground This hatchery also requires that the flock owner provide 3 to 4 square feet of housing per bird When giving a premium for larger flock size, some standard must be set for floor space at housing time, for the flock owner is prone to overcrowd the flock to get the extra flock premium

Hatchability also serves occasionally as a basis for hatching egg premiums However, despite the fact that the hatchability of eggs would seem to be the soundest basis for paying a premium, relatively few hatcheries have adopted this system When buying eggs on a hatchability basis, the lowest premium paid for the lowest hatching eggs must be somewhere in line with the premium paid for all hatching eggs by other competitive hatcheries The added premiums on top of this base for improved hatches have a tendency, then to increase the cost of hatching eggs without a corresponding increase occurring in hatching percentage over that obtained from all eggs bought on a

2. *High Egg Production throughout the Year.* Flock owners are supplied with chicks of the very best breeding by the hatchery. Their flocks are culled and bloodtested, and the non-laying hens are removed from the flock. The hatchery also insists on a good feeding and management program. All these features are conducive to high flock production.

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The letter reads as follows:

Important Message to All Flock Owners

Very Urgent That You Reply at Once

We are enclosing a card for you to fill out and return to us. Please do this at once, as we must have this information to plan our culling and bloodtesting schedule for this fall. Whether you want your flock culled early or late, please fill out the card and send it in now. We will set a date and notify you a few days ahead of time, as close as possible to the time you want the work done.

The rules require that pullets be 5 months of age or older, and they should be in at least 20% production when bloodtested. Therefore be sure to give us the exact age of your pullets, on the card. Also please be sure to give us your exact location from the nearest town, since we have men working who do not know where all our flock owners live. We need your telephone number, too, if you have one.

We will have a list of cockerels for sale in our office so if you need cockerels write or call us and we will tell you where you can get them. Please arrange to get yours early as the supply will be short.

Our fee for culling, bloodtesting and legbanding is 6¢ per bird (charging only for the good birds left in the flock), or a minimum charge of $6.00 if you have less than 100 birds. If you wish we will worm your birds at the time of culling for an additional 1¢ per bird; we can also delouse them for 1¢ each. Should a second or third blood test be necessary, no additional charge will be made. We will start culling soon so we need the information right away.

Don't let mites and lice take your poultry profits. We have a full line of poultry remedies in stock here and in most of our egg stations; our culling crews will carry a supply of these remedies.

PLEASE FILL OUT THIS CARD AND RETURN TO US AT ONCE, regardless of when you want the work done.

Cordially yours,

If no reply is received from the flock owner from the first letter mailed, a second letter is mailed two weeks later. This letter calls attention to the first letter mailed two weeks earlier and points out the importance of answering the second notice. The information card is again included in the second mailing.

If no reply is received from the second mailing, a personal typed letter is sent to the flock owner within two weeks after the second mailing. If no reply is received from this letter, a personal call is made on the flock owner to determine whether or not he desires to sell hatching eggs.

An organized program of follow-ups will result in a high percentage of favorable returns. The information contained on the postcards can

straight premium basis Another problem which is sometimes encountered when buying on a hatchability basis, and which is difficult to explain to the flock owner, is the flock that does not hatch well even when all practices are followed recommended to produce eggs of good hatchability The real reason may lie in the breeding inherent in the flock, and yet the breeding was supplied the flock owner by the hatchery The flock owner is thus penalized if eggs are bought from such a flock on a hatchability basis

Scheduling Flock Work

When working with flocks in an established territory, the hatchery may want to begin the work of lining up the various flocks for the annual fall culling and bloodtesting starting as early as August

Fill Out and Mail This Card Promptly

(Every year we have to write some people several times for this information. Why not really co-operate this year and fill out and mail this card back RIGHT NOW?—Thanks.)

Name____________________

Town______________ State________

Route____ Box____ Telephone No.________

Miles from town____ Direction________

Breed of Chickens?______________

Date pullets were hatched?____________

About how many hens and pullets do you expect to have for laying?____________

We require 1 male to every 10 females in heavy breeds and 1 to every 12 in Leghorns. Do you need more?______ If so, how many?______

Do you have some extra ones to sell?________

If so, how many?______ Price each $______

If ROP wing-banded put an X here______

When is the earliest we can cull and test?______

(Make the date early as possible and get rid of your culls, save feed.)

FIG 9–1 Return postcard sent by a hatchery to obtain information needed for the schedule of culling and bloodtesting work.

One hatchery uses a form letter addressed to each flock owner with a return postcard enclosed (see Fig 9–1), which the flock owner is to fill out and return, giving the information necessary for the hatchery to work out the culling and bloodtesting schedule

expense to the hatchery and is beneficial to the flock owner. Most flock owners will recognize the expense involved in service work and will be willing to pay a reasonable charge.

Number of Flocks Needed

With 50 per cent production, 100 hens will produce on the average 1 case of eggs (360 eggs per case) per week. For pullet and hen flocks housed in the fall of the year, from which eggs are to be used in the spring months, one can predict fairly accurately the production to be expected on the above basis. If the hatchery is planning on hot-weather operation in the summer and early fall months, production of good hatching eggs may not reach the anticipated level because of lower production and more cull eggs produced in the summer months.

One of the more common sized incubator units is of 52,000 egg capacity. With flocks of good production breeding and proper management, 4,000 breeding hens will supply all the hatching eggs needed to operate a 52,000-egg incubator to capacity for a season. The 4,000 hens should produce 40 full cases of eggs per week, which will fill the setting tray capacity of such incubators. If both setting and hatching tray capacity are included in the egg capacity of a machine, this should be considered in determining the number of hens needed. For example, the 52,000-egg incubator will take only 20 cases of eggs at a setting but is built to handle two settings per week, and thus it will use the egg production of 4,000 hens. On the above basis, 100 hens will lay enough eggs for each 1,000-egg setting and hatching capacity, with a slight surplus of eggs if conditions of weather and management are favorable to production.

EGG DELIVERY METHODS

Hatching eggs must be properly cared for on the farm where they are produced, and the egg delivery to the hatchery must be timed so that the eggs are trayed and set in the incubators immediately and without delay when they reach the hatchery. The importance of avoiding delays and holdovers of eggs in the hatchery is a point most often overlooked in hatchery operation.

Fresh laid eggs from breeding flocks should be properly cooled in open wire baskets before casing in cool cases. They should be held in a room or basement where the temperature is relatively constant, 55 to 60°. Figure 9–2 shows an unusually fine egg cooler on a flock owner's farm. This cooler provides both a uniform temperature and

be used to determine the date when the flock can be culled and the number of birds and amount of driving necessary to reach the flock All these matters must be considered in scheduling work for the culling and testing crew

Policy in Flock Service Work

There are some aspects of flock service work on which opinions may vary regarding policy in outlining a program for flock owners

For example, some hatcheries follow the practice of giving the breeding cockerel chicks to the flock owner at no charge, whereas others charge the flock owner the full price of the pedigreed cockerel chicks In some cases where pedigreed cockerel chicks are relatively expensive, the hatchery will charge the flock owner half price for the chicks and bear one half of the cost

If the hatchery retains ownership of the cockerels when putting them with the flock at no charge, the hatchery may be able to pay the cost of the cockerel chicks for the following season, by picking up the adult cock birds at the end of the hatching season and selling them on the market. The market price of an adult cock bird will nearly pay the cost of a good quality pedigreed cockerel chick The disadvantage of this system is that the flock owner may ask the hatchery to pick up the males at any time, particularly if it is necessary to cut eggs off for a short time, as may happen in periods of flush egg production and low chick demand during the spring months The hatchery may not wish to pick up the males for a short time when an improved demand for chicks is anticipated later

Another point on which hatchery policy may differ is the service charge for culling and bloodtesting work. The charge varies considerably with custom and competitive conditions in different areas Regardless of the amount charged, it will be difficult to show a profit from flock work Six to eight cents per bird has been a maximum charge for some years in the Middle West, and, considering the miles traveled and labor and expense involved, this charge will do little better than pay the costs, even with one time testing If it is necessary to retest the flock, most hatcheries do not make any additional charge Thus the retests are done at a loss to the hatchery Despite this competitive conditions exist where hatcheries may make no charge at all for this service work

Competitive conditions will determine the policy to be pursued in most areas, but it should be kept in mind that flock improvement is an

adequate moisture for maintaining optimum holding conditions on the farm.

Most flock owners deliver their own eggs to the hatchery or egg station. Sometimes, particularly where hatcheries are selling and delivering feed and other merchandise on routes, the hatchery may pick up the eggs at the farm. Farm pick-up routes are expensive, and the hatchery should consider the costs as balanced against returns before deciding to inaugurate a pick-up route.

Hatcheries with many egg stations in an area may operate large transport trucks between the egg supply area and the hatchery, as shown in Fig. 9–3. These trucks operate on an exact pick-up schedule. The flock owner is given a definite time to deliver hatching eggs to the egg station, and the truck arrival and departure are scheduled closely, so that the eggs are picked up soon after delivery by the flock owners and are sped to the hatchery at some distant point without delay.

Shipping eggs by rail is the least desirable of all transportation methods, because it is costly, there are many delays, and eggs are

FIG 9–4. Use of labels of this type is one means of getting improved handling of rail shipments of hatching eggs (Courtesy American Poultry and Hatchery Federation)

subject to rough and inexpert handling by inexperienced and disinterested persons. However, it is frequently impossible to operate trucks over long distances for a limited number of eggs, and it becomes necessay to ship them by rail.

For rail shipments, hatching eggs should be packed in the best possible cases, preferably new cases or used only one time. They should

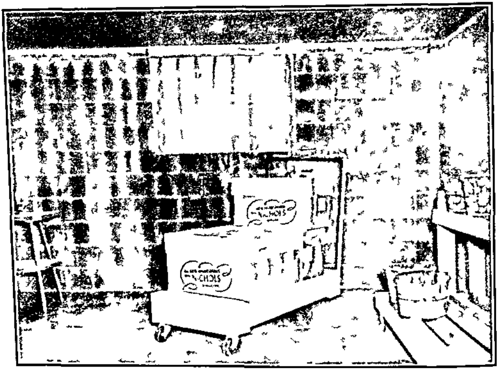

FIG 9-2 Egg holding room on flock owner's farm (Courtesy Nichols Poultry Farm Kingston New Hampshire)

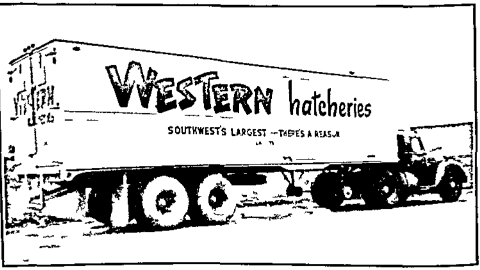

FIG 9-3 This large truck is used for transporting eggs from the flock supply area to the hatchery The interior of the truck body is maintained at a uniform temperature for hatching eggs both summer and winter (Courtesy Western Hatcheries Dallas, Texas)

in the fundamentals of good poultry husbandry Therefore, by various means it is necessary to give the flock owner information and instructions that will result in the production of good quality hatching eggs for the hatchery

One means of getting this information to the flock owner is by a poster (Fig 9–5), which gives pointers on the care of hatching eggs

How To Care For Your Hatching Eggs

1 *Gather eggs three or four times daily in wire baskets*
2 *Cool in basement overnight*
3 *Buff Only - - Do not wash*
4 *Case following morning with small end down*
5 *Keep lid on cases and eggs cool until delivery*

— — *WESTERN HATCHERIES*

Fig 9–6 This label is attached to each egg case that the flock owner receives as a constant reminder to care for hatching eggs properly (Courtesy Western Hatcheries, Dallas, Texas)

At the time the flock is culled and tested, the selecting agent can discuss the points of this program with the flock owner and leave the poster nailed to the wall inside the poultry house as a reminder

Another reminder to the flock owner of the importance of good egg care is a gummed label pasted on each egg case that the flock owner receives every week, as shown in Fig 9–6 This label states briefly the essential points in good care of hatching eggs

The egg delivery ticket that the flock owner fills out each week with the number of dozens delivered can also carry this important information to the flock owner (Fig 9–7)

The fact that so many different means have been developed to acquaint flock owners with the importance of proper egg care shows the importance which hatcheries attach to such instructions Low hatches, which have been traced to improper care through lack of adequate knowledge, are the chief reasons why it has been found necessary to stress this information

be labeled properly, with the name and full address of the consignee, and any other type of labeling that will promote careful handling of the eggs en route (See Fig 9–4)

INSTRUCTIONS TO FLOCK OWNERS

Most farm flock owners are general farmers, interested primarily in grain and livestock production, and are not particularly well founded

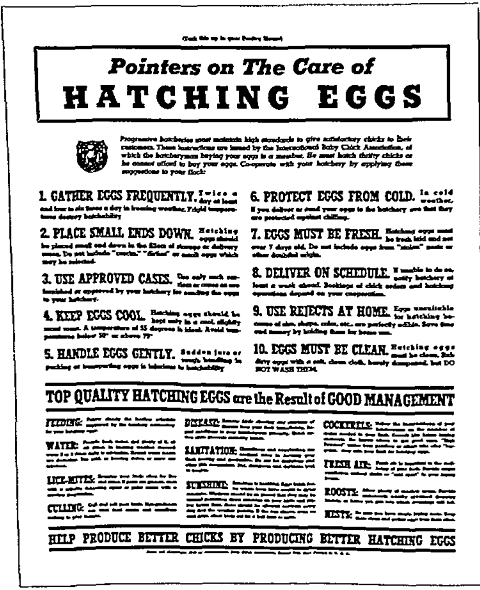

FIG 9–5 This poster gives essential information on care of hatching eggs and management (Courtesy American Poultry and Hatchery Federation)

HATCHING EGG COSTS

Hatching egg costs will vary in different sections of the country depending on local market and competitive conditions. The cost of producing hatching eggs may also vary depending on feed costs and labor costs in different areas.

A survey of prices paid by various hatcheries by Margulis (1953) shows considerable variation, as shown in Table 9-1.

Table 9-1 Hatching egg price listings April 24 through May 5, 1953

Hatchery	State	Gross Price Paid per Dozen
A	Massachusetts	90¢ and hatchability
B	Ohio	67¢
C	Texas	57¢ Lights 6[illegible]¢ Heavies
D	Missouri	58¢
E	Missouri	54¢
F	Missouri	58¢
G	Illinois	55¢
H	Missouri	61¢
I	Ohio	75¢
J	Illinois	56¢
K	Texas	75¢
L	Texas	70¢ for broiler type 57¢ for White Leghorns
M	Arkansas	75¢
N	Pennsylvania	95¢ New England 83⅓¢ local
O	Illinois	53¢
P	Indiana	69¢
Q	Indiana	56¢
R	Pennsylvania	70¢ to 94¢ Bred
S	Illinois	55¢ Standard Bred 62¢ Crossed Bred—58¢ average
T	Pennsylvania	83¢

In this survey, it appears that broiler hatching egg prices in the East were reasonably well stabilized at 90 to 95 cents depending on transportation and handling costs. Egg type hatching eggs from a high type of flock were available at about 80 to 83 cents in the East. These quotations were for U.S. Pullorum Clean flocks and for a very good production type of breeding.

In the Middle West, the average price for good production stock (with the exception of Ohio) runs from 55 to 61 cents per dozen. The difference could be accounted for in extra hatchability premiums and individual preferences for special services and breeding given by selected flock owners.

HATCHING EGG DELIVERY RECORD

Flock Owner's Name ______________________

Breed ______________ Date ______________

Instructions to Flock Owners Concerning Hatching Eggs

Great care must be given to eggs that are to be hatched Handle carefully—do not bump or jar them. They must not chill. They must not lie in the sun They should be gathered twice a day (and oftener in cold weather) and kept in a cool not too dry place After an egg is 5 days old it declines rapidly in hatchability

Sort out all odd shaped dirty small irregular checked and rough eggs Tap eggs gently to make sure they are not cracked Do not wash eggs. We do not want cracked small or irregular shaped eggs neither can we use dirty eggs.

Pack eggs in case with small end down — be sure and fill every pocket and every layer in the case and turn egg case daily

Hatching eggs must be delivered at least once each week

Form 372 Printed in U.S.A

DUPLICATE Hatchery Record

	DOZENS	PART DOZ.
No Eggs Delivered	______	______
No Eggs Rejected	______	______
No Eggs Purchased	______	______
Price Per Doz	______	______
Amount Paid	______	______

Eggs Trayed ______________

Chicks Hatched ______________

Hatchability ______________%

By ______________

Fig 9-7 The hatching egg delivery record may also carry instructions to flock owners concerning hatching eggs (Courtesy American Poultry and Hatchery Federation.)

the hatchery may receive just as many eggs as previously if the flock owner is told to bring only half. The hatcheryman can figure the number of eggs needed, based on orders on hand and in prospect, and regulate egg deliveries accordingly.

It is desirable to have control of setting and buying of eggs if surpluses of chicks are to be avoided. A system that has been used with success is based on the following:

January 1 to March 10—	Set 2 eggs for each chick sold
March 11 to May 10—	Set 2½ eggs for each chick sold
May 11 to October 31—	Set 2 eggs for each chick sold
October 31 to December 10—	Set on orders only

Hatcheries selling and shipping chicks by mail usually do not hatch from December 10 to January 1, as it is difficult to ship satisfactorily during the Christmas rush season.

To set 2 eggs for each chick sold, at 70% hatch, would mean 140 chicks hatching for each 100 sold. From March 10 to May 10, figuring 2½ eggs to each chick sold and 75% hatch, would mean 187 chicks hatching against 100 sold. This gives 3 weeks to sell the 87 additional chicks, which usually is easy to do during the peak season of demand. To set too close to orders on hand would mean that some customers would have to wait too long for their chicks and would buy elsewhere.

This survey, made from April 24 through May 5, 1953, reflects prices paid for hatching eggs when the Chicago current receipt price for market eggs was 47 cents per dozen

A study by Vickers (1952) shows the cost of producing market and hatching eggs when the feed cost is $5 per 100 pounds These results are shown in Table 9–2

Table 9–2 Cost of producing market and hatching eggs

(Feed cost $5 per 100 lb)

Per Cent Egg Production	Eggs per Hen per Year	Leghorns Market Egg Cost per Dozen	Heavy Breeds Market Egg Cost per Dozen	Heavy Breeds Hatching Egg Cost per Dozen	Extra Cost Hatching Eggs Above Market Eggs Heavy Breeds
10	37	$1 84	$2 09	$2 34	$0 25
20	73	0 945	1 08	1 21	0 13
30	110	0 65	0 735	0 82	0 095
40	146	0 50	0 57	0 635	0 065
50	183	0 41	0 465	0 515	0 05
60	219	0 355	0 40	0 44	0 04
70	256	0 31	0 35	0 384	0 034

The data on hatching egg flocks in this study were based on use of 6 males per 100 hens Some hatcheries use 8 to 10 males with heavy breed flocks

Is the production of hatching eggs profitable for the flock owner? From a comparison of paying prices in Table 9–1 and costs of production in Table 9 2, it would appear to be very profitable for some With egg premiums averaging 12 cents to 15 cents per dozen eggs over market price for eggs from production type flocks, it would appear that with 50 per cent or better production, the flock owner should find producing hatching eggs a profitable enterprise

CONTROL OF EGG BUYING AND SETTING

At times it may be necessary to cut down on the number of hatching eggs being bought from flock owners This can be done by cutting off certain stations or by cutting down on the deliveries made by each flock owner Experience has shown that the most effective way to cut down on the number of eggs being delivered to the hatchery is to tell the flock owner the exact number of eggs to bring to the hatchery For example, if the flock owner is now bringing 30 dozen eggs per week to the hatchery and only 15 dozen are needed, it is more effective to tell the flock owner to bring 15 dozen than to tell him to bring only half his eggs Some flocks apparently take a spurt in production when eggs are being cut off, and under such conditions

Egg Costs

In all hatcheries the largest item of expense is the cost of the eggs, and to be successful the hatchery owner must obtain the maximum number of good, salable chicks from them

Egg costs include the amount paid to the flock owner, commissions to the egg station if the eggs are handled through a station, trucking or express charges and return of empty cases Flock improvement may also be added to egg costs and includes flock improvement labor, cockerels antigen, bands flock fees, transportation, and any other expenses incidental to servicing the flock

Incubation and Hatching

Costs of incubation and hatching include labor for setting eggs, taking off chicks, cleaning machines, and counting and grading chicks If the owner or various members of the family do the work, their labor should be figured as part of the cost of production at wages equal to those which the hatchery would have to pay if it were necessary to hire help from the outside

Chick boxes and pads, and labor in punching out the boxes to allow ventilation, are part of the incubation and hatching costs Some hatcheries in areas with a uniformly mild climate buy boxes with the ventilating holes punched and cleaned out, which cuts down on the labor of assembling If a sizable quantity of boxes are carried over from the preceding season in inventory, an adjustment should be made to arrive at accurate costs There may be a substantial difference in the expense between flock replacement and broiler hatcheries especially in sections where delivery boxes are reused several times The cost of tieing and stitching wire enters into box cost, but it may be charged to hatchery supplies

Sexing expense varies depending on the size of the hatchery and the number of chicks hatched that require sexing Flock replacement hatcheries have a big demand for pullet chicks, and in some areas broiler hatcheries are finding a demand for sexing

Insurance policies sometimes cover a 3 or 5 year period, and an adjustment should be made to pro rate the expense for the time under consideration

Repairs to buildings and equipment, such as painting, replacing broken glass, repair of roofs, replacing controls on machines, are among the many everyday items of upkeep and maintenance which enter into the cost of incubating and hatching chicks

10

Cost of Producing Baby Chicks

A knowledge, and accurate accounting, of the actual costs of producing chicks is one of the most essential aspects of the hatchery business. However, studies have shown that it is a phase most often neglected. Some hatchery owners and operators apparently dislike "book work" and shy away from the detail of daily record entries, which are a necessary part of any well regulated business. Cost studies by the American Poultry and Hatchery Federation reveal that some hatcheries use virtually a "scrap paper" system of record keeping, that many do not have adequate records for income tax purposes, that some do not take advantage of tax deductions available to them, and that in at least one hatchery pricing was regularly two cents per chick less than production costs. Continued "blind" operation without a system of accurate cost records can only lead to eventual failure and bankruptcy for the hatchery business, which operates on narrow margins and demands top efficiency for adequate profits.

CLASSIFICATION OF COSTS

What are the costs of producing chicks? Briefly, they can be classified as (1) the cost of eggs, (2) incubation and hatching costs, (3) selling and delivery, and (4) administrative and general. Taggart (1952) writes,

> each cost will differ widely between breeder hatcheries, plants supplying flock replacements and those producing broiler chicks, and most of you will be surprised how these costs vary among hatcheries in your classification. This business is not radically different from other industries. If costs and selling prices are kept in line you have the foundation for a successful enterprise. *Sell below cost and you are headed for trouble.* If, during distress periods, you sell chicks at five cents each, how many do you have to sell at your list price to make up the loss?

Table 10-1 *Your Work Sheet* *

Chicks hatched	
Less culls	
Less extras	
Salable chicks	

	For the Year	Per Chick	
Egg costs Hatching eggs			
Flock improvement, labor, cockerels, servicing, vaccinating, banding, delivery, etc			
Incubating and hatching Labor			
Power, fuel, water			
Chick boxes, pads, twine, wire, etc			
Insurance			
Repairs—building			
Repairs—hatchery equipment			
Supplies, fumigants, etc			
Taxes—local, payroll			
Depreciation			
Trucking			
Selling and delivery Commissions and salaries			
Travel, entertainment			
Advertising promotion			
Delivery expense			
General and administrative Owner-manager			
Office salaries			
Office supplies			
Telephone and telegraph			
Legal and accounting			
Bad debts, donations, dues and subscriptions			
Chick adjustments			
Miscellaneous			
Interest			
Total			
Total, exclusive of egg costs			

* This Work Sheet can be used to determine cost of production on a "per chick" basis. Courtesy J. I. Taggart.

Hatchery supplies may include disinfectants, floor sweeping compound, incubator cards, in fact, anything used in the general hatchery operation which is not specifically set forth in another account

Taxes, local, payroll, and federal and state taxes on income—all are expenses and must be accounted for.

Depreciation on buildings and equipment is legitimate expense and should be figured on the basis used in income tax reports The per cent depends on the type of construction, but in most sections 2½ per cent per year is the average for buildings With incubators, the allowable depreciation varies from 6 per cent to 12½ per cent, depending upon established practice and on the number of months per year they are operated

Collecting eggs from stations and transporting them to the hatchery are expenses chargeable to trucking Gas, oil, tires, and truck repairs all enter into the cost of producing chicks

Selling and Delivery

Advertising in national publications, local papers, radio, or television are items of cost in selling chicks and may amount to a considerable sum if not wisely budgeted Printing of catalogs, circulars, office supplies such as letterheads and envelopes, all are costs of selling In the course of selling to large dealers in broiler or commercial layer chicks, travel and entertainment become items of expense, as well as commissions and salaries Postage for mailings and for shipping chicks by parcel post, express shipping charges, or trucking costs will enter into the expense of delivery

Telephone and telegraph costs are usually listed as administrative expenses but in fact may actually be selling costs, as large quantities of chicks are sold by phone

General and Administrative

The drawing account or salary of the owner manager, office salaries, telephone and telegraph, legal and accounting, bad debts, donations, dues and subscriptions, chick adjustments, interest on borrowed capital, all are items of administrative expense Some may question chick replacements or adjustments as an expense, but it can only be offset by selling additional chicks and, therefore, becomes a cost in production

Bank charges, moving expense, feed purchases for plant use such as for started chicks, chicks purchased for resale, janitor and cleaning expense, water, express, freight and drayage on items shipped in

Table 10–2 shows the relation of various items of operating costs to total chick cost for a midwestern mail order hatcheryman in specified years between 1935 and 1951. This hatcheryman's total chick production has held fairly constant each year, with the exception of 1943 and 1945. It is apparent that the percentage of cost allocated to management has gone steadily upward. This could be explained in part as

Table 10–2 Operating costs in relation to total chick cost

This table shows the relation of various items to the total cost of producing baby chicks for a successful midwestern mail order hatcheryman in specified years between 1935 and 1951. Courtesy American Poultry and Hatchery Federation.

	1935 %	1940 %	1943 %	1945 %	1950 %	1951, % *
Hatching eggs	46.1	44.3	60.9	55.2	48.9	56.4
Wages (5 to 7 employees)	8.9	8.9	6.9	9.0	11.8	10.9
Postage and express	11.1	12.7	9.5	8.8	8.5	6.2
Advertising (catalogs, circulars, newspapers)	13.6	12.4	8.0	8.6	8.2	6.5
Supplies, boxes, sanitation, flock improvement, gasoline and oil	5.6	5.2	5.0	5.1	6.3	5.9
Heat, light, water, and power	1.5	1.4	0.7	0.9	1.0	0.9
Sexing		1.2	1.8	2.1	1.3	1.1
Interest and depreciation	5.5	4.7	2.2	2.7	3.4	2.9
Management's wage	6.2	7.7	4.2	6.6	9.6	8.2
Insurance and taxes other than personal income tax	1.5	1.5	0.8	1.0	1.0	1.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Estimated for fourth quarter.

an offset to sharply higher income taxes and living expenses. Egg costs percentagewise fluctuate sharply from year to year. However, it should be recognized that, though dollars' and cents' cost of an item may remain fairly constant, the percentage value of the item as a part of the total may be made to fluctuate by changes in costs of other items of expense.

Table 10–3 shows the costs of producing a day old chick in 1951 according to a survey made by the American Poultry and Hatchery Federation (1951). These costs varied from a low of 10.4 cents per chick for hatchery L located in the West North Central states area to a high of 16.7 cents per chick for hatchery C located in the same general area. The added labor for started chicks has apparently increased the production costs of hatchery C at least 1 cent per chick, but the cost is still higher than the average for all hatcheries reported

"collect" for shipping charges—all enter into the expense and costs of producing chicks and should be accounted for

Taggart (1952) has prepared a work sheet, which is shown in Table 10–1, for the purpose of arriving at the cost of producing chicks based on all production costs In determining current costs of production he states,

> by checking the egg cost per chick, the operator knows this expense each day The other costs cannot be definitely determined until the end of the year, but you can use the previous year as a guide Thus the operator may know that, in the previous year, his costs, exclusive of eggs, was 6 16 cents per chick Therefore, as soon as the operator has his per cent hatch, he can add the egg cost to 6 16 cents and establish the total cost per chick Barring radical changes in operations, this will be a good estimate People who have kept records for several years find that this is true

The chief error that many hatcheries apparently make is a failure to recognize the various cost items that they do actually have in producing baby chicks By following an outline and system such as shown in Table 10–1, the hatcheryman should be able to make an accurate determination of chick production costs

A COMPARISON OF COSTS OF DIFFERENT HATCHERIES

It is difficult to make a comparison of production and selling costs that can be used from year to year with any degree of accuracy because of the changing price level of many of the items of cost that go into producing baby chicks For example, a study made in 1933 of 19 Iowa hatcheries shows that total production expense was only \$3 5742 per 100 chicks and that total chick cost including managerial expense was \$6 16 per 100 chicks In this study, egg cost was only \$2 0781 per 100 chicks or a total of 33 73 per cent of total cost Total selling expense was 22 88 per cent of the total cost, total production expense 58 01 per cent of the total, and 19 16 per cent was given as "managerial return or expense"

Price relationships as shown by percentages do not appear to be a reliable index for comparison A study of 110 Maryland hatcheries by Poffenberger and DeVault (1939) shows egg cost as 63 7 per cent of the total cost of producing chicks This might be compared with the 33 73 per cent reported for the Iowa hatcheries above, or with the 39 per cent to 56 per cent shown in a study of 15 hatcheries made in 1948 Changing price levels and a difference in accounting procedures make it difficult to compare costs

Table 10-3 Cost of producing a day old chick, 1951

(Data courtesy American Poultry and Hatchery Federation)

Hatchery Fiscal period ending	A 9/30/51	B[1] 7/31/51	C[1] ?	D 7/31/51	L 11/30/51	K 9/30/51	L 12/15/51	M 6/30/51	N 12/31/51	Average
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Eggs	10.2[2]	7.3	7.7	7.0	8.7	9.0	6.2[3]	9.0	10.4	8.4
Labor	0.6[4]	1.0	2.6[5]	2.0	1.1[6]	1.7[6]	1.3	0.9	1.8	1.4
Supplies	0.4	0.5	0.7	0.5	0.8	0.5	0.6	0.4	0.5	0.54
Utilities	0.8	0.2	0.4	0.5	0.2	0.8	0.3	0.1	0.1	0.42
Truck		0.1	0.3		0.2	0.4[7]	0.4[7]	0.05	0.1	0.15
Postage, express		0.6		0.1	0.2	1.5[8]	0.2	0.5	0.9	0.55
Advertising sales	0.7	0.0	2.3[9]	0.6	0.1	0.3[10]	0.1	0.0	0.7	0.92
Fixed depreciation, taxes, insurance interest	0.1	0.4	0.8	1.0	0.1	0.4	0.9	[11]	0.6	0.5
Other repairs, contributions etc	0.0	1.5	1.9	1.9	0.5	0.4[12]	0.4[13]	0.1	0.1	0.85
Total	13.7[14]	12.5	16.7	14.5	11.9	15.0	10.4	11.95	15.2	13.73
Area	N E	E N C	W N C	E N C	S E	S E	W N C	E N C	Pac Coast	Total

[1] All or virtually all flock replacement chicks produced

[2] It is interesting to note that this large hatchery, producing millions of chicks annually is able to keep total cost lower than some, despite higher hatching egg cost Hatcheryman does not however, give us any data on truck, postage, and express costs Egg cost here includes flock improvement cost

[3] Hatchery is apparently paying same for light breed hatching as for broiler hatching eggs Over two thirds of volume are broiler chicks

[4] A 12 month operation cuts labor cost per chick

[5] Large started chick plant connected, labor includes that required to supervise brooding plants

[6] Includes $4 500 for management in total payroll of $32,000

[7] Heavy use of trucks to deliver chicks and feed

[8] No explanation available on heavy postage, express Not a mail order hatchery It might be that express cost refers to express "in" on eggs

[9] Mainly flock replacements hatched with sales concentrated in mail order areas of West North Central and South Central states

[10] Specializing in broiler business, this hatcheryman uses personal contact to make sales

[11] Tax and depreciation items unavailable

[12] 25% of the miscellaneous item is made up of adjustments, refunds with another 25% allocated for telephone and rent No doubt, part of telephone expense could rightfully be charged to sales efforts

[13] 75% of this miscellaneous amount is for building and equipment repairs

[14] Sexing has been omitted from all costs offered here

Table 10-2a Income and expenses per chick produced *

(From Stucky)

Type of Operation	A Retail Broiler	B Retail Broiler	C Retail Broiler	D Retail Farm Flock	E Retail Mail Order Farm Flock	F Retail Mail Order Farm Flock	G Wholesale Farm Flock
Incubator capacity	120,000	200 000	134,000	80 000	104,000	390,000	90,000
Number of chicks sold	790,000	1,298,000	1,011 000	212,000	160 000	1,100,000	300,000
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Sale price	15 42	16 00	13 49	18 49	11 14	10 92	9 55
Cost of sale	8 95	10 48	8 71	9 91	6 75	5 04	6 08
Gross margin	6 47	5 52	4 78	8 58	4 39	5 88	3 47
Operating expenses							
Labor	2 62	2 14	1 29	3 85	0 39	1 17	0 75
Sexing	0 03	0 25	0 15			0 14	0 07
Advertising	0 20	0 04	0 09	0 34	0 30	0 89	0 25
Office expense	0 02	0 02	0 03	0 26	0 01	0 49	
Delivery expense	0 07	0 06	0 04		0 54	0 06	0 03
Freight	0 04				0 00	0 78	0 73
Heat and power	0 41	0 35	0 18	0 77	0 36	0 15	0 20
Telephone		0 01	0 05	0 09	0 05	0 08	0 13
Supplies	0 19	0 53	0 34	0 07	0 75	0 41	0 10
Travel	0	0 04	0 05	0 18	0	0	0
Depreciation	0 27	0 22	0 29	0 38	0 42	0 09	0 08
Repairs and maintenance	0 12	0 10	0 12	0 04	0 01	0 14	0 02
Taxes	0 13	0 09	0 09	0 01	0 03	0 02	0 08
Insurance	0 44	0 08	0 02	0 10	0 04	0 10	0 03
Rent	0 02	0 27	0	0 01	0	0	0 08
Interest	0 01	0	0	0	0	0	0
Miscellaneous	0 17	0 92	1 15	0 90	0 09	0 35	0 02
Total	4 73	5 07	3 80	8 28	3 97	4 82	2 82
Net profit	1 74	0 45	0 92	0 30	0 42	1 06	0 65
All costs	13 68	15 55	12 57	18 19	10 72	9 86	8 90

* Seven selected Indiana hatcheries 1950

A study of Mississippi hatcheries reported in 1953 states that, for the period June 1949–May 1950, "on the average it cost $9.80 to hatch 100 chicks in Mississippi." (See Table 10–4.) Variable costs were

Table 10–4. Average costs of hatching 100 chicks, prices received, and margins by size groups *

59 Commercial chick hatcheries, Mississippi, June 1949–May 1950

Incubator Capacity	Hatcheries	Average Costs per 100 Chicks: Fixed	Variable	Total †	Price per 100 Chicks ‡	Margin between Total Average Costs and Average Prices Received
	Number	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Under 30 000	29	1.73	7.36	9.07	12.95	3.88
30 000–59 999	18	2.09	7.98	10.08	13.40	3.32
60 000–89 999	5	1.14	7.88	9.02	13.20	4.18
90 000 and over	7	1.40	8.80	10.20	12.80	2.60
Total or average	59	1.50	8.30	9.80	13.00	3.20

* *Southern Cooperative Series Bul.* 34, Commercial hatchery operations in six southern states, July 1953, p. 29.

† Does not include labor of hatchery owner and/or family labor.

‡ Weighted.

approximately 85 per cent of the total costs with egg cost being the most important item. It should be pointed out that, of 59 hatcheries participating in this study, 29 were under 30 000 capacity. Of this the study states "most operators having capacities of 30 000 eggs or less performed all or most of their own labor, and total costs for hatcheries of this size would have been higher if the operator's and/or family labor had been included. Inclusion of an adequate charge for labor would no doubt bring the Mississippi costs more nearly in line with those reported in Table 10–3. The study comments on the figures:

> the relationship of high variable costs relative to total costs indicates that commercial hatchery production is very flexible and sensitive to changes in chick prices. In an industry in which costs are largely variable, the number of firms and their production levels are usually subject to wide variations. A small increase in price will attract new firms and a small price drop will depress marginal firms. With high variable costs in relation to total costs it would probably take only a small decrease in the price of chicks for hatcheries to fail to recover much more than their variable costs, assuming that hatcheries are not operating on a large margin. In the short run, a hatchery might continue to produce as long as variable costs were covered by the price of chicks. In the long run, however, the hatchery must recover both variable and fixed costs or cease operation.

at 13 73 cents per chick The footnotes to Table 10–3 supply certain explanations regarding the costs of each hatchery studied that merit attention and study

Stucky (1954) reports costs of production ranging from 8 90 cents to 18 19 cents per chick for 7 selected Indiana hatcheries in 1950 These 7 hatcheries obtained over 95 per cent of their income from chick sales The results of this study are shown in Table 10–2*a*

Commenting on the figures from this study Stucky states,

> the low cost of sales figure for hatchery F resulted from the firm's ability to base its hatching egg purchase price on a low local current receipts market price Moreover, it paid only a ten cent per dozen hatching egg premium, and almost two thirds of its output was produced in the spring months when the hatchability percentage is highest Hatcheries B, C, and D bought eggs based on established Grade A prices plus a hatchability premium of up to 28 cents per dozen for eggs hatching 90 per cent or better
>
> The egg costs of broiler chick producers A, B, and C reflected the higher egg costs typically encountered by this type of operation in the summer and fall The higher egg cost of broiler chick production can be seen in the cost of sales figures of hatcheries C and F as these two firms are located in the same community Of course it must be remembered that other factors were responsible for some of the differences between these two operations
>
> There was a difference of over five cents per chick in the operating expenses of the two extremes Surprisingly, both high and low figures were in relatively small hatcheries which produced farm flock stock (hatcheries D and G) while the four hatcheries selling around one million chicks per year varied less than 1¼ cents in expenses per chick Variation in costs per chick can be present in large operations as a result of differences in items such as egg cost, labor freight and the contribution to fixed overhead by sideline sales but apparently even more variation can occur in small hatcheries because a disproportionate absolute amount of fixed dollar expense in labor, depreciation expense on facilities etc, can have a very pronounced effect on costs per chick
>
> In comparing the expenses of firms D and G, one immediately notices the higher labor cost of 3 85 cents of D It might be said that this comparison is unfair because operator of G took as part of his personal return an amount which the owners of D paid out for hired labor Yet this difference in operating practices is precisely the reason why some small operators are willing to sell their product at a low price In effect they are willing to accept a labor return as a major part of the earnings of their business
>
> Total costs (cost of sales and expenses combined) ranged from a low of 8 90 cents to 18 19 cents The average sale price of the seven firms increased in the same order as did total costs (from G with a cost of 8 90 cents and a sale price of 9 55 cents up to D with a cost of 18 19 cents and a selling price of 18 49 cents) It is easy to see therefore how a hatcheryman having costs approaching those of A or C would think that a competitor such as F or G was selling possibly even below his variable cost

A study of Mississippi hatcheries reported in 1953 states that, for the period June 1949–May 1950, "on the average it cost $9 80 to hatch 100 chicks in Mississippi" (See Table 10–4) Variable costs were

Table 10–4 *Average costs of hatching* 100 *chicks, prices received, and margins by size groups* *

59 Commercial chick hatcheries Mississippi, June 1949–May 1950

Incubator Capacity	Hatcheries	Average Costs per 100 Chicks: Fixed	Variable	Total †	Price per 100 Chicks ‡	Margin between Total Average Costs and Average Prices Received
	Number	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Under 30 000	29	1 73	7 36	9 07	12 95	3 88
30 000–59 999	18	2 09	7 98	10 08	13 40	3 32
60 000–89 999	5	1 14	7 88	9 02	13 20	4 18
90 000 and over	7	1 40	8 80	10 20	12 80	2 60
Total or average	59	1 50	8 30	9 80	13 00	3 20

* *Southern Cooperative Series Bul* 34 Commercial hatchery operations in six southern states July 1953 p 29

† Does not include labor of hatchery owner and/or family labor

‡ Weighted

approximately 85 per cent of the total costs with egg cost being the most important item It should be pointed out that, of 59 hatcheries participating in this study, 29 were under 30,000 capacity Of this, the study states, "most operators having capacities of 30,000 eggs or less performed all or most of their own labor, and total costs for hatcheries of this size would have been higher if the operator's and/or family labor had been included" Inclusion of an adequate charge for labor would no doubt bring the Mississippi costs more nearly in line with those reported in Table 10–3 The study comments on the figures

> the relationship of high variable costs relative to total costs indicates that commercial hatchery production is very flexible and sensitive to changes in chick prices In an industry in which costs are largely variable, the number of firms and their production levels are usually subject to wide variations A small increase in price will attract new firms and a small price drop will depress marginal firms With high variable costs in relation to total costs, it would probably take only a small decrease in the price of chicks for hatcheries to fail to recover much more than their variable costs, assuming that hatcheries are not operating on a large margin In the short run, a hatchery might continue to produce as long as variable costs were covered by the price of chicks In the long run, however, the hatchery must recover both variable and fixed costs or cease operation

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>
> Total costs (cost of sales and expenses combined) ranged from a low of 8 90 cents to 18 19 cents The average sale price of the seven firms increased in the same order as did total costs (from G with a cost of 8 90 cents and a sale price of 9 55 cents up to D with a cost of 18 19 cents and a selling price of 18 49 cents) It is easy to see therefore how a hatcheryman having costs approaching those of A or C would think that a competitor such as F or G was selling possibly even below his variable cost

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Incubator Capacity	Hatcheries	Average Costs per 100 Chicks: Fixed	Variable	Total †	Price per 100 Chicks ‡	Margin between Total Average Costs and Average Prices Received
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30,000–59,999	18	2.09	7.98	10.08	13.40	3.32
60,000–89,999	5	1.14	7.88	9.02	13.20	4.18
90,000 and over	7	1.40	8.80	10.20	12.80	2.60
Total or average	59	1.50	8.30	9.80	13.00	3.20

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approximately 85 per cent of the total costs with egg cost being the most important item. It should be pointed out that, of 59 hatcheries participating in this study, 29 were under 30,000 capacity. Of this, the study states, "most operators having capacities of 30,000 eggs or less performed all or most of their own labor, and total costs for hatcheries of this size would have been higher if the operator's and/or family labor had been included." Inclusion of an adequate charge for labor would no doubt bring the Mississippi costs more nearly in line with those reported in Table 10–3. The study comments on the figures:

> the relationship of high variable costs relative to total costs indicates that commercial hatchery production is very flexible and sensitive to changes in chick prices. In an industry in which costs are largely variable, the number of firms and their production levels are usually subject to wide variations. A small increase in price will attract new firms and a small price drop will depress marginal firms. With high variable costs in relation to total costs, it would probably take only a small decrease in the price of chicks for hatcheries to fail to recover much more than their variable costs, assuming that hatcheries are not operating on a large margin. In the short-run, a hatchery might continue to produce as long as variable costs were covered by the price of chicks. In the long-run, however, the hatchery must recover both variable and fixed costs or cease operation.

INVESTMENT IN HATCHING FACILITIES

The study in Mississippi included information on investments in the hatchery enterprise It showed that there was an average investment of $178 per 1,000 egg capacity (Table 10–5) Land and buildings

Table 10–5 *Relationship of incubator capacity to investment per 1 000-egg capacity* *

Incubator Capacity	No of Hatcheries	Average Incubator Capacity	Average Total Investment	Investment per 1 000 Egg Capacity
	Number	*Number*	*Dollars*	*Dollars*
Under 30 000	29	14,541	2,944	202 46
30 000–59 999	18	42,350	8,515	201 06
60 000–89 999	5	73,200	13,676	186 83
90 000 and over	7	142,571	21,030	147 51
Total or average	59	43 221	7,699	178 13

* 59 commercial hatcheries Mississippi June 1949–May 1950

accounted for 40 per cent and equipment 60 per cent of the total investment Of the total land and buildings cost land comprised one-fourth and buildings three fourths Equipment costs were principally for incubators, which accounted for more than two thirds of total equipment costs Other equipment included trucks, cars brooders, and miscellaneous items

There appeared to be a relationship between investment per 1,000 egg capacity and size Investment per 1,000 egg capacity declined as total capacity increased It was about $200 per 1,000-egg capacity for those hatcheries having under 60 000-egg capacity and somewhat less than $150 per 1,000 egg capacity for those of 90,000 capacity or larger In this study of 59 hatcheries, incubator capacity averaged 43,221

COST FACTORS IN PRICE-MAKING

Chick prices in Mississippi for the period studied averaged $13 00 per 100 chicks (Table 10–4) There was considerable variation among hatcheries although no particular pattern was apparent based on the

capacity of the hatcheries Hatcheries having a capacity of 90,000 eggs and over had an average price of $12 80 per 100 chicks, and those with a capacity from 30,000 to 60,000 had an average price of $13 40

The average margin for all hatcheries in the Mississippi study was $3 20 per 100 chicks (Table 10–4). The margin ranged from a low of $2 60 for hatcheries with a capacity of 90,000 eggs or more to $4 18 for those having a capacity of 60,000 to 90,000 eggs

The *Harvard Business Review* (1952) comments on cost factors in price making as follows

costs influence prices but do not control them, except in a limited and special sense Goods sell for what buyers think they are worth, whether this price is more or less than cost Business must recover from its total revenues its total costs, but not every sale will show an adequate individual profit A contribution to overhead is all that can be expected from some classes of business

Most enterprises will go to great lengths to maintain volume, continue operations, protect trade position Sales will be made close to cost (or even below cost) before the operation is abandoned On the other hand wide profit margins are eagerly accepted, actively exploited

In a free economy no seller is "entitled" to a price which will cover his costs He is entitled only to the price the market affords He must learn to live on that price, or quit He cannot burden the buyer with excess costs, he must absorb them himself

The above philosophy applies in some respects to the baby chick industry On the other hand, with narrow operating margins, the successful hatcheryman will of necessity weigh each factor of cost and pricing with an eye to profit on each operation

THE BANKER AND CREDIT REQUIREMENTS

Hatchery operation requires considerable amounts of operating capital at certain seasons of the year Cooke (1952) gives the following advice on arranging for credit needs

Few take the time or trouble to set the stage for doing business with their bank Operators might well file a financial statement yearly, even though borrowing is not planned Call on your banker two or three times a year and discuss operations, even though no borrowing is planned

Discuss credit and financing *before* committing oneself to a loan If the banker cannot be convinced that the loan purposes are sound and constructive, perhaps the customer should take it easy It is much easier for a bank to loan in anticipation of needs and to take care of future requirements than to loan when a person is desperate and has a deadline to meet

for acts performed previously Then the bank does not think the best judgment has been used This situation is the reason for the belief that banks will lend when you don't need funds but are hesitant to lend when the need exists

Advantages of bank credit include increase in net income by buying for cash with discounts, possibility of orderly handling of expenses with loan payments out of sales, assistance in growth and facility improvements, relief from financial complications

Disadvantages of bank credit if abused too rapid a rate of expansion with disastrous results sometimes, prevents accumulation of sufficient cash reserves whereby, if low prices, disease, or other difficulties arise, forced liquidation may bring loss to all concerned, prevents orderly conversion of profits into assets

Bank loans should be paid promptly or renewed by mutual agreement between the bank and hatcheryman on the date due This helps to establish the hatcheryman as a good credit risk for future loans

THE COST OF PRODUCING STARTED CHICKS

Some hatcheries make a business of producing started chicks These chicks are fed and cared for in battery brooders for varying lengths of time from 1 to 6 weeks old One of the most popular ages of chicks for shipment to customers is the 3- to 4 week-old chick At this age, the chicks are large enough to withstand the strain of shipping and can still be shipped in cardboard shipping boxes Older chicks must be shipped in wooden shipping boxes

There are few accurate cost records on producing started chicks because the started chick business is a relatively small part of the operation of most hatcheries and so the started chick operating expense is usually included in the general hatchery operation expense

Most started chicks are priced F O B the hatchery They are shipped by railway express, and with increases in express rates there has been a decline in the demand for started chicks shipped by rail On the other hand, some local hatcheries, where started chicks are picked up by the customer at the hatchery, are reporting an increase in the demand for started chicks

Started chicks reared in battery brooders will require about 1 man per 10,000 to 12 000 chicks to take care of cleaning, making boxes and catching and shipping They may also require heat early in the brooding period which will add considerably to the costs, particularly

where electric rates are high The cost of feed and vaccinating for Newcastle disease in producing started chicks must also be included in calculations of costs

A study of the started chick prices of several hatcheries in 1953 shows that 3-week old chicks are priced at 13 to 17 cents per chick over day-old prices One hatchery offered to pay transportation costs to the first zone for day-old chicks plus 20 cents per chick, and adds 2 cents per chick for each added zone shipped to, that is, 22 cents added for shipment to zone 2, 24 cents for shipment to zone 3, etc

Started chicks are shipped in heavy-weight fiberboard boxes, with 34 chicks per box Started boxes are equipped with feeders and cups for watering en route

The extra cost of shipping boxes, pads, labor in cleaning, feeding and watering, cost of electricity for lighting, heating the brooders, cost of fuel for heating the building, labor in catching and shipping, mortality—all are costs that enter into the production of started chicks, in addition to depreciation on buildings and equipment These costs are variable but must be considered in pricing started chicks

11

Factors Affecting Hatchery Profits

Profits in the hatchery business are directly concerned with those items that affect income and expense Volume of sales and correct pricing in relation to production costs influence income, and overall production management and the ability to buy correctly from the standpoint of quantity needed and price are factors influencing expense

A study made by Poffenberger and DeVault (1939) showed that hatchery profits were influenced by (1) gross income and cost, (2) efficiency in the use of fuel, (3) efficiency in the use of labor, (4) investment, (5) egg cost, (6) hatchability of eggs, (7) source of eggs, (8) premium paid for eggs, (9) number of chicks hatched, (10) hatchery capacity and capacity utilized (11) selling cost, (12) cost of allowances, (13) length of hatching season, and (14) marketing practices

The above factors are of prime importance today, and careful study and thought should be given to each by those who wish to make a success of the hatchery business

GENERAL

The hatchery business as conducted by many hatcheries today, is a low margin of profit business as compared with other types of business Many other businesses operating today figure a wide margin of profit Some hatcherymen, on the other hand, may be content with one half cent per chick profit on a chick selling for 14 cents, a profit margin of less than 4 per cent

Hatcherymen produce a highly perishable product, the baby chick This chick must have a buyer when it is hatched If the chick is not sold when hatched, it must be either brooded until sold (and usually this is impossible because adequate brooding facilities are not available) or it must be sold at a sacrifice price, or as a last resort destroyed

Farm customers, who buy baby chicks, have learned that hatcheries can supply chicks during the spring months on a moment's notice. In fact, many of them expect to get chicks on the day they decide to buy, and if they cannot get them from one hatchery will go to another to buy.

All these factors have led to a system of pricing by some hatcheries which is based entirely on what their competitors price their chicks at, and not on costs of production plus a certain percentage markup, as is customary in other types of business.

The successful hatchery of the future will operate efficiently to keep production costs as low as possible, will price its product on the basis of actual costs plus a profit markup, and will set close to orders to prevent surpluses.

Organization

An enthusiastic management, which works hard and plans ahead, and interested, efficient working personnel can do much to make a hatchery successful and profitable.

Planning ahead from day to day, and from season to season, is essential in the hatchery business. The hatchery placing its flock replacement chicks in the spring of the year must look ahead to the following year to determine the breeds that will be needed, the number of pullets needed in each breed and cross, and the number of cockerel chicks that must be placed with each lot of chicks going to flock owners. All this depends on the size of operation planned for the following year and the anticipated trends in demand for the various breeds of chicks.

A successful hatchery manager makes a practice of planning each night the work that is to be done the next day. When he arrives in the morning, he assigns enough work for the day to keep each person profitably occupied. If work has already been assigned, he checks to see that the employees are going ahead with the work, sees that work is done without waste effort, that work is not being put aside to be finished later.

In the hatchery, a daily check should be made on the progress of the work, to make certain that eggs are being handled correctly, that they are being checked in and paid for promptly, and that eggs are being set while fresh and not allowed to age while being held on the floor of the hatchery. Incubators should be checked to see that they are clean and sanitary, that all operating instructions are being carried out, and that temperature and humidity readings are correct. The hatch

FIG 11 1 Clean up is an important phase of the modern hatchery's operation (Photo courtesy Corn Belt Hatcheries Joliet Illinois)

ery should be clean at all times and free from fire hazards (See Fig 11–1)

Egg Costs

Egg cost of producing 100 chicks is the greatest single item of cost Anything that increases this cost out of proportion to other costs will have an adverse effect on profits

The egg cost of producing 100 chicks is influenced by the original cost of the eggs and the per cent of hatch Factors influencing the original cost of eggs are the number of cull eggs that may be paid for as hatching eggs and then sold at a loss on the market and the number of hatching eggs that are bought at premium prices and then sold on the market because sufficient orders are not on hand to justify setting them after they have been purchased

If we assume that the average hatchability of all eggs set is 70 per cent it will require approximately 12 dozen eggs to hatch 100 chicks For each increase in cost of hatching eggs of 8 cents per dozen the cost of producing 100 chicks is increased by $0 96 or approximately

$1 00 This basic fact is of importance in considering increases in egg premiums or in anticipating prices for the coming season, based on an unknown egg market

It is easy to increase premiums for hatching eggs and almost impossible to reduce them once they are increased Increasing egg premiums without some justification accomplishes very little Too often, hatcheries increase egg premiums because of some unfounded rumor A little investigation of such rumors before making a decision to increase the hatching egg premium would frequently save a lot of misunderstanding later, when all competitors are required to increase their own premiums because of the hasty action of some member of the industry

One of the most frequent causes of dissension among flock owners is their habit of considering hatching egg premiums only, without estimating or inquiring about the base over which the premium is to be paid A high hatching egg premium over a low market egg base will often mean a lower total egg income than a low premium over a higher or graded market egg base

Those hatcheries which operate during the summer and fall months for broiler production will more and more have to consider the factors of egg price and hatchability in pricing their chicks Egg prices are usually higher during the summer and fall months than at other times of the year In addition, many hatcheries have started paying an extra premium for eggs during the summer months to encourage the summer or so called "off season' production of hatching eggs Without a program for the proper care of hatching eggs during hot weather, hatchability may fall as low as 30 to 40 per cent Even with good care, hatchability during hot weather is usually as much as 5 to 10 per cent lower than during the spring months High egg costs, plus lowered hatchability, mean an excessively high egg cost of producing 100 chicks

A study of 7 hatcheries with varying egg costs and varying percentages of hatch, operating during the summer fall season of 1952, showed the results tabulated herewith

Hatchery	Egg Cost per Dozen	Ave % Hatch	Egg Cost per Chick
1	70 7¢	60 1	9 66¢
2	78 9¢	70 8	9 27¢
3	72 6¢	74 0	8 15¢
4	62 2¢	64 5	8 08¢
5	59 8¢	71 4	6 97¢
6	54 1¢	65 8	6 85¢
7	52 2¢	69 0	6 20¢

It is interesting to note that, although Hatchery 3 had a higher egg cost than Hatchery 1, the egg cost of producing 100 chicks was reduced by $1 51 because Hatchery 3 had an average of 14 per cent higher hatchability than Hatchery 1 Hatchery 7 with an 18 5 cents' lower egg cost and approximately 9 per cent increased hatch, compared to Hatchery 1, had an egg cost per 100 chicks of only $6 26 or $3 40 less than Hatchery 11 It is apparent that egg costs and hatchability must both be given top consideration in planning an efficient and competitive hatchery program

Labor Costs

Hatchery labor expense is another important item of cost in producing baby chicks Particularly, hatcheries operated for the production of flock replacement chicks for layers find that production expands to a high peak during the spring months and tapers off during the summer and fall months Such extreme seasonal business requires considerably more help at some seasons of the year than at others Hatcheries should consider their payroll each week from the standpoint of volume of business and prospects for the immediate future, and should adjust accordingly A carryover of unneeded help in the "off" season can soon use up much of the profit made in the peak hatching season

In order to establish some standard basis of cost comparison on labor, the hatchery should compare total labor cost in relation to the operation, such as number of eggs being set, number of chicks being hatched, or number of hens being culled

A study of several different hatcheries based on a full year's operation in 1952 gave the results indicated herewith

Hatchery	Hatchery Labor	Office	Total Labor Cost per 100 Chicks
A	$1 4041	$0 2286	$1 6327
B	1 4232	0 3381	1 7613
C	1 4069	0 4164	1 8233
D	1 4066	0 5111	1 9177
E	1 3569	0 4427	1 7996
F	0 8422	0 1778	1 0200

Hatcheries A–F show remarkable uniformity in hatchery labor costs with the exception of Hatchery F, where the hatchery labor cost was over 50 cents per 100 chicks less than the other hatcheries If it were selling chicks at the same price as Hatchery D, Hatchery F could

show 89 cents per 100 chicks more profit, all other costs being equal, simply because it had lower labor costs in both the hatchery and the office

How Much Labor?

Frequently, a problem arises of determining how much labor can be employed efficiently All persons employed in a hatchery may be busy, but because of inefficient organization they may not be earning their way compared with other hatcheries where labor organization is more efficient

One hatchery issues the following instructions on hiring labor.

> You are allowed 1 man for each 52,000 egg capacity unit which is being operated In addition to this, you add the superintendent and truck driver If you have a flock supervisor, you may count him as additional For example, if you are actually setting eggs in 8 units, you are entitled to a maximum of 8 men, plus superintendent and truck driver, making 10 men in all

In correspondence with several eastern hatcheries inquiring about the use of labor, the following replies were received

> We figure 1 man per incubator for actual hatchery operation Of course, we have some extra men on the payroll, but their primary duties lay elsewhere, they put their time in the hatchery when slack, or in inclement weather We work 9 hours per day, approximately a half day on Saturday
>
> The men in the hatchery do not do any culling or testing, this is done by either our service men, who are on the road all the time, or by an outside service The foreman, who is a maintenance man, does most of the repair work
>
> We have no special plan for advancement, other than advances through seniority or special individual merit It is the job of the hatchery manager, who, we feel is paid enough for it, to see that the work is done as well as possible, and whose responsibility it is to get the best hatches possible, through proper incubation, fumigation, egg handling, etc

Another New England hatchery replies as follows

> We of course have a commercial hatchery All bloodtesting is done by the state and our supply flocks are large
>
> We have eight 78 000 machines and employ 2 night men working in 8 hour shifts 7 full time day men, 2 part time men working 40 hours each week and 2 girls for grading working 30 hours weekly Full time men work 54 hours weekly We do all our maintenance work and repairs We have no incentive plan we give employees a bonus at the end of the year based on length of service

Still another New England hatchery writes

we have 6 incubators with an egg capacity of 78 000 eggs each We use 8 full time men and 1 part time man besides a girl that works 4 days a week making boxes Two of the full time men work nights Our men work 9 hours a day 54 hours a week They alternate on Saturday nights and Sundays

All men work in the machines and do the grading delivering and traying One of the 6 men who works in the capacity of foreman does the reconditioning work We have no incentive plan for better hatches except the personal pride the employees take in the hatchery We hatch 4 times a week rather than 2 which more evenly distributes the cleaning grading and delivering

Fig 11 2 Chicks removed from trays in the incubators are dropped into the floor opening shown above onto a continuous conveyor belt which carries them to the counting table outside the incubator The tray card precedes the chicks on the belt thus identifying the breed and flock owner (Courtesy Hogan Farms Hatchery Muskogee Oklahoma)

Time in Work Studies

So far as is known there have been very few studies on the time required to do the various jobs in the hatchery and there is scanty information on the volume of work to be expected in a given time

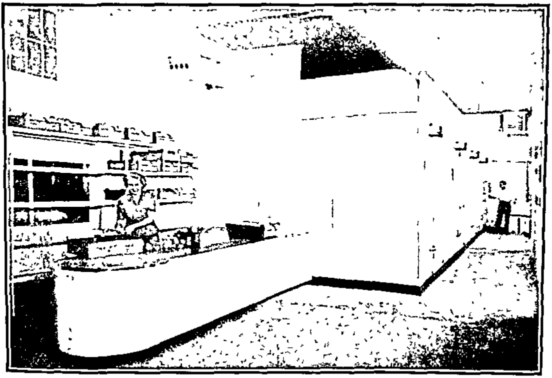

Fig. 11–3. Chicks being removed from incubator on conveyor belt. Such a conveyor eliminates taking boxes in the machine and then carrying chicks to the sorting table. One operator on the machines and two on the grading table can empty four 52,000-capacity machines in less than 1 hour. (Photo courtesy Hogan Farms, Muskogee, Oklahoma.)

The following is a summary of time-in-work studies made at 3 different hatcheries over a 2-week period. It will give a general idea of the amount of work that can be expected from help in the hatchery.

1. The number of chick boxes that can be made up (holes punched, stapled, complete with spacing cleats and excelsior pads):

20 to 25 boxes per man per hour (100-size boxes)

2. The number of trays that a man can tray up in 1 hour (steel trays holding approximately 150 eggs per tray):

8 to 9 trays per man per hour

Note: Some hatcheries report 12 to 14 trays per hour.

3. The number of chicks that a man can grade and count per hour:

2,500 to 3,000 per man per hour

4. The length of time it takes for a man to clean a 52,000-capacity incubator, including removing trays and hatch racks, cleaning the floor, cleaning fan blades, and setting down the eggs:

2½ hours per 52,000-egg capacity

5 The number of chicks that can be tied, stamped and shipped per hour

25 to 30 boxes per man per hour

Platteville Chickeries, Platteville, Wisconsin, have worked out a complete outline for each hatchery job, giving the exact duties to be

FIG 11–4 Modern well arranged brooder rooms reduce labor and cut production costs (Photo courtesy DeWitt s Zeeland Hatchery Zeeland Michigan)

performed, the time required and has worked each job out on an incentive basis to reward those who do good work based on certain standards that have been set up For example, the base pay on traying eggs (1952) is 8 cents per tray They figure that a fast trayer can tray as many as 17 trays of eggs per hour A bonus of 2 cents per trav is offered to those who qualify at the end of the hatching season

Figures 11–2 11–3 and 11–4 show some modern arrangements which help to reduce labor and cut production costs

CHICK COST STUDIES

The American Poultry and Hatchery Federation made a study of several phases of costs related to chick production. These were reported by Turnbull (1952) as follows.

The study shows that a hatchery does not have to be large to be successful. It does have to be well managed, regardless of size.

In this study, the 11 hatcheries ranged in size from 28,000 capacity up to 260,000 capacity. The smallest hatchery in the group could set only 6,900 eggs a week, whereas the largest one could set 72,000 eggs a week. It shows, among other things, that, all factors being equal, the length of season may be more important in reducing chick cost than size of the plant.

Table 1 below shows hatcheries divided into two groups, those with weekly setting capacity of less than 15,000 eggs and those with a weekly setting capacity of over 15,000 eggs.

Table 1. Effect of size of hatchery on incubation costs

Hatchery	Capacity per Week	Incubating Cost per 1,000 Eggs Set
1	13,000	$28.58
2	6,900	39.92
3	14,400	33.29
4	12,300	30.99
5	6,900	43.20
Average		35.20
6	28,800	31.81
7	22,400	34.34
8	22,400	31.73
9	36,000	30.55
10	72,000	28.23
11	21,300	31.60
Average		31.45

Difference of $3.75 per 1,000 eggs set or $5.62 per 1,000 chicks sold

The last column on the above table shows the total incubation cost at each hatchery per thousand eggs set. This total incubation cost includes the manager's salary, all additional labor, utilities, taxes, depreciation on equipment, rent or taxes and depreciation on the buildings, repairs and maintenance, insurance, trucking and shipping expense, traveling expenses, banking charges, bloodtesting and vaccinating, etc., in fact, all costs except hatching eggs, chick boxes and sales expense.

You will note that there is a difference of only $3.75 per thousand between the cost of incubating eggs in the small hatcheries as compared with the larger hatcheries. Most of this difference of $3.75 was in labor. The

5 The number of chicks that can be tied stamped and shipped per hour

25 to 30 boxes per man per hour

Platteville Chickeries Platteville Wisconsin have worked out a complete outline for each hatchery job giving the exact duties to be

Fig 11–4 Modern well arranged brooder rooms reduce labor and cut production costs (Photo courtesy DeWitts Zeeland Hatchery Zeeland Michigan)

performed the time required and has worked each job out on an incentive basis to reward those who do good work based on certain standards that have been set up For example the base pay on traying eggs (1952) is 8 cents per tray They figure that a fast trayer can tray as many as 17 trays of eggs per hour A bonus of 2 cents per tray is offered to those who qualify at the end of the hatching season

Figures 11–2 11–3 and 11–4 show some modern arrangements which help to reduce labor and cut production costs

The second group had an index of incubator use of only 11 8

The last column in Table 3 shows the total incubating expense per thousand eggs set The first group had an average expense of $30 24 per thousand, whereas the second group had an average incubating cost of $35 41, or a difference of $5 27 per thousand eggs set, or $7 91 per thousand chicks sold, which again is a larger difference than was shown when these same hatcheries were compared on the basis of their size

Table 3 Index of incubator use

Hatchery	Index	Incubation Cost per 1 000 Eggs Set
6	14 4	$31 81
1	23 8	28 58
10	20 5	28 23
11	15 9	31 60
4	14 5	30 90
Average	17 8	30 24
7	11 2	34 34
8	11 3	31 73
9	13	30 55
2	12 5	39 92
3	9 2	33 29
5	13 3	43 20
Average	11 8	35 51

Difference $5 27 per 1 000 eggs set or $7.91 per 1 000 chicks sold

These three tables show three different methods of comparing various hatcheries They indicate that the cost of incubating eggs in the respective hatcheries was only slightly affected by the size of the hatchery, that the Index of Incubator Use and the total number of chicks sold in comparison to the number of eggs set were more important

Three important factors therefore, if not the main factors aside from egg cost, in producing chicks are

1 *Constant Sales Promotion* to assure a longer season
2 *Inventory Control* The manager must have a knack for keeping and using complete, efficient records so as to avoid, as much as possible, the need for disposing of distress merchandise by destruction or otherwise, and
3 *Good Incubation* The incubators must be carefully operated and the supply flocks carefully supervised, so as to get the highest possible hatches

Meeting these requirements there is no reason why the smaller community type hatchery or local hatchery can t compete effectively insofar as production costs are concerned

difference between these two groups in total labor was $3 15 per thousand eggs set

Table 2 shows these same hatcheries arranged according to the number of chicks sold *in proportion to the eggs set*

Table 2 Effect of per cent of salable hatch on incubation costs

Hatchery	Total Hatch %	Salable Hatch %	Incubating Cost per 1 000 Chicks Sold
6	75 8	64	$44 34
8	76 8	65	49 27
1	73 0	66	43 15
9	84 0	65	44 40
10	84 2	69 9	40 57
11	75 9	70 2	45 05
Average			44 45
7	71 0	63	54 24
2	74 9	61 9	64 46
3	70 3	60 9	53 41
4	72 1	62 3	50 67
5	70 5	63	68 30
Average			58 25

In incubating cost difference of $13 80 per 1 000 chicks sold

All of these hatcheries had a fairly satisfactory total hatch for the year However, those with the highest total hatch did not always have the highest percentage of chicks sold

Some of them had to destroy a larger proportion of chicks than others You will note that the average incubating cost for the first group was $44 45 per thousand chicks whereas the second group had a cost of $58 25 a difference of $13 80 per thousand chicks sold

This could indicate that the number of chicks sold in proportion to the number of eggs set is much more important than the size of the hatchery as a controlling factor in determining chick cost

Table 3 shows these same hatcheries arranged according to the length of the season To measure the length of the season the total number of eggs set in a 12 month period has been divided by the total number of eggs the hatchery *could* set in a single week The resulting figure is referred to as the Index of Incubator Use

If you will refer to Table 1 again you will note that Hatchery 6 could set 28 000 eggs per week We divide this figure into the total number of eggs actually set by this hatchery in the year and we find that it went into the larger number 14 4 times Thus this hatchery s operations during the period actually equalled 14 4 weeks at maximum capacity

In Table 3 the average index of incubator use for the first group of hatcheries is 17 8 or in other words this group turned out during the fiscal year the equivalent of 17 8 weeks at maximum capacity

erels Data of the Massachusetts Experiment Station show that 51 2 per cent of March chicks and 50 3 per cent of April chicks were cockerels There is this indication, at least, of a slightly higher per cent of males early in the season However, the ratio should not vary more than 2 per cent from a 50-50 ratio

FIG 11-5 Accurate chick sexing influences profits by reducing claims (Photo courtesy Hubbard Farms Walpole, New Hampshire)

If a larger number of cockerels are being sexed out consistently it means that the doubtful pullets are being thrown into the cockerel box without sufficient time being taken to judge the sex accurately With pullet chicks selling at 30 cents each and cockerel chicks at 4 cents each in Leghorns, an inaccurate job of sexing can have a very adverse effect on profits

Regardless of the size of operation, the hatcheryman is lost who cannot pinpoint his costs

Our studies show to date that all too frequently the hatcheryman fails to take into consideration 100 per cent of his costs He's forgetting his investment, or the expense of delivery, he's forgetting to set aside to himself a wage which he might have to pay someone else if for any reason he was incapacitated and could not perform his duties He's frequently assigning to some other phase or sideline a cost which should be borne by the hatchery or he is in some manner or another subsidizing a phase of his operations without the intent of doing so

OTHER FACTORS INFLUENCING HATCHERY PROFITS

Buying Supplies

Real savings can often be made by getting prices from different firms having the same product for sale, by buying in quantity, and by paying promptly upon receipt of merchandise to take advantage of discounts offered by many firms for payment within 10 days from receipt of invoice

Several smaller hatcheries may combine their orders for chick boxes, pads, or some other item that they all use in the hatchery, and get the advantage of lower prices usually offered for larger quantity purchases

Printing costs for circulars, catalogs, envelopes, etc, may frequently be reduced by combining orders, ordering a full season's supply to take advantage of quantity discounts, and figuring sizes to take full advantage of standard sheet sizes, so that the printer is not forced to waste printing paper for circulars of odd sizes The printer can advise on circular sizes which can be cut without waste, and he should be consulted before the order for printing is placed

Sexing

Accurate chick sexing can influence profits by reducing claims and correspondence, which result when too many cockerels are found in the pullets after the chicks are large enough for the sexes to be readily identified (See Fig 11–5)

Inexperienced sexors may have trouble in identifying all pullet chicks accurately at day old These "doubtful chicks are thrown in with the cockerel chicks, thus causing a loss of income to the hatchery, since pullet chicks are priced considerably higher than cockerel chicks

The hatchery should check the sexing of chicks early in the season to see that the number of pullets and cockerels sexed from straight run chicks approximates a 50 50 ratio, that is, half pullets and half cock

around 55 miles an hour One hatchery reported reducing repair costs by more than half after governors were put on trucks

Incubators should be thoroughly cleaned, painted, and repaired annually Hatchery employees frequently do not realize the value of an incubator and are careless in working with these machines The incubator is far more valuable from a cost standpoint than a piano or other valuable furniture in a home and should be treated and cared for accordingly

Collections of Accounts Due

Ideally, all business should be on a strictly cash basis However, this is often not possible, and it becomes necessary to carry some accounts on the books for varying lengths of time Unless some definite system of collection is followed, the account may be allowed to drag along until it becomes increasingly difficult to collect Accounts allowed to remain long overdue may become uncollectible and thus result in a loss to the hatchery

An invoice for the amount due should accompany all shipments or deliveries of chicks If chicks are shipped by rail, the invoice may be mailed separately If chicks are delivered by truck, the invoice may be presented to the customer by the driver If the chicks are not paid for on delivery, it is a good policy to ask the customer to sign for the delivery, acknowledging that the chicks were received in good condition

An invoice upon delivery of the chicks and a followup invoice on the first of the month is usually sufficient to collect from most customers If these methods fail, it is sometimes helpful to phone or write the customer

Roberts, writing in *Feedstuffs* (1952), states

> on the supposition that you can catch more flies with honey than you can with vinegar, the experts have found it best to sugar the collection letter until persistent silence or deliberate refusal to pay compels the creditor to drop in a dash of the bitter "Get your money and keep the customer" is the golden rule of collection practice

A series of no more than 6 letters are suggested The series of letters for collection can start with something like the following

> Busy people sometimes overlook settlement of past due accounts Your account with us will be off your mind if you send us a check today

Another factor to be considered in sexing heavy breed chicks is that the production type heavy breed cockerel can no longer be sold for meat purposes, as has been done for many years in the past This is particularly true of breeds such as the S C Rhode Island Reds, which are very popular in some sections as egg layers The Red cockerels are not acceptable to the broiler grower because of dark feathers, frequently slow feathering, and sometimes slow rate of growth Therefore, the Red cockerels must be sold at a discount in order to move them This should be considered in pricing Red pullets, or any production type heavy breed pullet when the cockerels cannot be sold at a profit for meat purposes

Care of Equipment and Supplies

Careless handling of equipment and supplies can result in considerable loss to the hatchery, causing frequent replacement of equipment and loss of supplies

Culling crews frequently carry supplies such as remedies, worm capsules, louse powder, etc, with them on the truck as they service the flocks Such supplies should be kept in a strong wooden or metal box, so that they are protected from the weather Supplies allowed to become wet are ruined for later use Labels on jars or boxes, which are continually exposed to the sun, become faded and do not present a very salable appearance to the customer

Culling coops should be strapped together when moving from one farm to another Frequently, a coop may be lost from the truck if some provision is not taken to keep the coops strapped together and on the truck.

Antigen for testing should be employed only as needed Any extra supply on hand should be left at the hatchery under refrigeration Some testing cabinets have glass or porcelain plates These plates should be allowed to cool after heating, before they are washed Some testers immerse the warm plates in cold water, thus causing them to break

Trucks are among the most valuable of the equipment owned by the hatchery A definite program of truck care should be adopted to prolong the life of the truck and keep it constantly in good repair Trucks should be greased and have the oil changed regularly Filters should be changed at regular intervals, and tires should be checked regularly Trucks used on regular long trips with different drivers may last longer if speed governors are attached, to limit the speed to

panding his chick hatching operations. Now, this alternative usually can be taken only in the face of difficult competitive conditions or under conditions that are less favorable than those presented by other

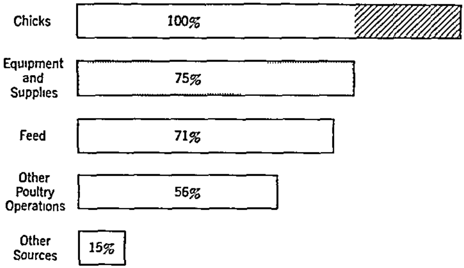

FIG. 11–6 Percentage of Indiana hatcheries obtaining income from five major types of items, 1947.

sideline enterprises. For example, in 1947 only about 8 per cent of the hatcheries thought that their community could support an increase in incubator capacity. Less than one-half of this small group operated hatcheries having an incubator capacity of 50,000 eggs or over.

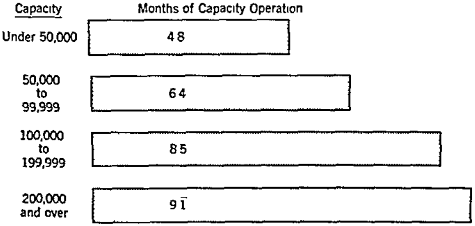

FIG. 11–7. Average length of hatching operations at full capacity in months for the Indiana hatcheries which operated at full capacity, by incubator capacities, 1947.

Fourth, some side lines have added stability to the hatcheries' operation. Hatcheries' income fluctuates with the relative profits of poultry operations. To offset the ever-present possibility of unprofitable

When all else fails, it may be necessary to seek the services of an attorney for collection If you feel you must sue to get your money, stick to courtesy For example

> We appreciate the injury to your personal pride your credit, social standing and your business reputation to have an account against you collected by law We do not want to injure you with court proceedings, but we have a just claim and no one can criticize our insistence upon prompt settlement We want to keep away from lawyers, if possible So, before placing your account for collection, we will wait 5 days for a check

Refunds

Excessive refunds may be caused by poor quality chicks, poor production practices which lead to claims, or too liberal an adjustment policy Guarantees as to livability, condition on arrival, etc, should be carefully considered before being offered, and then should be adhered to strictly The cause of excessive refunds should be determined and corrected as soon as possible In some areas, customers have come to expect a "too liberal adjustment" because they have learned that others have been given such adjustments, and they feel they are entitled to the same treatment regardless of what would seem fair under ordinary circumstances

SIDELINE INCOME OF HATCHERIES

Stucky and Wood (1947) found that 75 per cent of Indiana hatcheries handle poultry equipment and supplies, 71 per cent handle feed, 56 per cent maintain other poultry operations, and 15 per cent have additional miscellaneous sources of income (Fig 11-6) They found that the typical Indiana hatchery obtains 52 per cent of its gross income from chick sales, 24 per cent from feed, 13 per cent from other poultry operations and 9 per cent from equipment and supplies

According to the Indiana study, a number of basic principles have motivated sideline developments

First, many hatcherymen found a need for other types of enterprises in their communities Therefore, the addition of other operations often proved to be profitable

Second, some hatcheries added specific side lines to aid the original operation of hatching baby chicks Excellent examples are breeding farms and hatching egg supply farms

Third, side lines proved an easy method of expansion In the past a hatcheryman who wanted to expand his business could do so by ex

In the Indiana study, feed was found to be the most important volume side line (Fig 11-8) Although more hatcheries handled equipment and supplies than feed, the latter was easily the most important volume side line The average Indiana hatchery obtained 24 per cent of its gross income from feed sales in 1947

The importance of feeds also can be seen in the opinions of hatcherymen on the relative profit of side lines Forty per cent listed feed

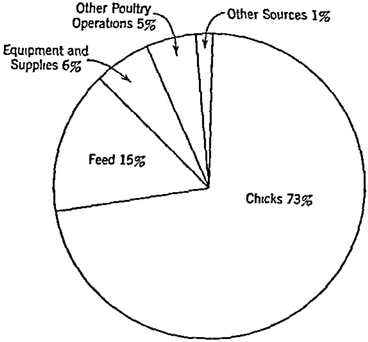

Fig 11-8 Percentage of gross income derived from five major types of items by Indiana wholesale hatcheries, 1947

as their most profitable side line An additional 13 per cent indicated that feeds were profitable to the business None of the remaining hatcheries which handled feeds (approximately 20 per cent) planned to drop feed from the business About 5 per cent of the small group which did not handle feed intended to add a feed sales department

Hatcheries have encountered various problems with equipment and supplies Some have found that equipment side lines often involve an excessively high inventory investment A few which sold seeds found that the seasonal demand was short and that it occurred during the hatching season The problem of meeting price, trade in, and service competition for items such as appliances and electrical equipment has discouraged some hatcherymen about these side lines

Hatcherymen who added egg marketing operations attempted to solve a major problem of hatchery management the maintenance of a

hatching seasons, hatcherymen added other operations, some of which were totally unrelated to agriculture.

Finally, side lines have helped balance out labor supply and income. Hatchery operations are highly seasonal. The average Indiana hatchery operated 6.9 months in 1947, but the average operation at full capacity was only 2.1 months (Fig. 11–7). Since the chick income is concentrated in a few months, many hatcherymen have turned to other enterprises in an attempt to equalize the year's income.

Many hatcherymen have found it difficult to locate an adequate supply of labor for the hatching season. By adding side lines, hatcherymen shifted emphasis from one enterprise to another and thus employed a well-trained staff on a year-round basis. This procedure also aids the hatchery program in that it provides a profitable means of contacting chick customers during the off-season.

The Indiana study points out, however, that the addition of side lines frequently presents many problems.

Many hatcherymen find it difficult to maintain a quality chick program while trying to develop side lines. Many believe that an extensive diversification may easily result in slighting the original hatchery objective. One hatcheryman said, "You can't run the chick business and sell everything under the sun as some are trying to do."

Some operators even believe that too many side lines will eventually decrease the quality of chicks to the point where the hatchery as we know it today will disappear. One hatcheryman believes that the poultry industry must put forth more effort to produce good products, or we will see a trend toward the breeder-type hatchery and the standardized farm at a central point with patented trade names.

Some hatcherymen also have found that the problem of being "spread thin" reduces the profit of the sideline enterprise. Another hatcheryman said, "To make a success of a side line requires house-to-house canvassing. Just to 'put it in' or 'have it in stock,' one would be better off not to add the side line." A simple survey of a particular community should show whether a particular side line will succeed or fail. Many unprofitable side lines could have been avoided had the hatcherymen made such a survey.

In addition, some side lines require a sizable investment in inventory. Because most hatcheries are small businesses, an outlay of a large sum of money may easily jeopardize the financial structure of the business. The additional business risk incurred through diversification presents many problems, particularly at a time when prices and business costs are relatively high.

12

Advertising and Selling

The art of selling baby chicks is not something that you work out the day the chicks hatch It is an everyday effort [J I Taggart]

Selling is an essential phase of the hatchery business Many hatcheries have been successful in producing quality chicks but have failed because they were unable to sell their production On the other hand, some hatcheries have been able to sell but could not hold their customers because the quality of their chicks was too poor to bring repeat sales A good sales program requires careful planning, year round selling, and a good product

The sales program should be planned to sell the volume of chick production anticipated by the hatchery Although it is possible through advertising and sales effort to oversell the production of the hatchery, such overselling is not likely and would prove in most instances to be the exception The sales program should be planned to spread the sales of chicks over a period of time that would permit a uniform rate of production, rather than to group all the sales within a period of a few weeks

A sales program should also be planned to acquaint the buying public with the hatchery's product ahead of the peak buying season, when the demand for chicks is normally greatest For example, a survey (see Table 12–1) made by *Successful Farming* magazine (1952) showed that 86 per cent of 579 Midwest farm families purchased their baby chicks in the months of March, April, and May To build up interest ahead of the peak season, the advertising for this area would have to be planned for January and February, with some tapering off in the promotion in March and April as the demand builds up From Table 12–1, it can be seen that it would be very speculative to carry on extensive advertising in months such as July and August when the demand for chicks is normally very light However, the fall months may bring a greater demand for chicks in some areas than is indicated

satisfactory flock owner relationship An egg marketing department helped many hatcheries improve their local customer relations Others have found that, unless some volume was achieved, the additional service and labor required for a quality egg program by the hatchery was considerably more than the compensation derived from it

A number of hatcherymen have attempted to solve the flock owner problem by selling hatching eggs However, a few of this group found that the costs of maintaining the egg source (culling, testing, etc) was too great to justify a specialized program In Indiana, 7 per cent of the hatcheries that sold hatching eggs and market eggs reported those items the most profitable side line in their business Some reported that other operations such as broiler and turkey production were quite profitable

by this survey A breakdown of the total numbers of flock replacement chicks and broiler chicks sold each month in the United States is shown in Table 12–2

POINTS TO STRESS IN SELLING CHICKS

The theory of present day advertising and the selling approach are well expressed in this verse from a famous advertising specialist

> Tell me quick and tell me true
> Less—"how this product came to be ,
> More—what it will do for me!

Although it is desirable to give some background of the business, where it is located, how long established, and the personnel, the fact remains that the customer is primarily interested in the results he can expect from the product he buys Therefore, in talking to the prospect, person to person or through advertising it is well to stress the word 'You," for example "You Get More Eggs from Layers Raised from Our Chicks,' or "You Can Make More Profit"

To determine the appeal that will best sell chicks it is desirable to survey the market for chicks and determine the kind of chicks that the customer wants as well as the kind that will make him the most profit under typical conditions of management in a given area The appeal to the commercial egg producer or broiler raiser would be somewhat different than the appeal to a farm flock poultry raiser The commercial producer is interested only in substantiated facts, which will show him how he can make more money from a certain strain of chicks The farm flock poultryman desires both egg and meat production from his flock and is ordinarily not as critical a buyer as the commercial producer

The *Successful Farming* survey of farm families covering chiefly the West North Central states, made in May 1952 showed that 68 per cent of the farms kept hens and 32 per cent did not keep hens On the family farms with hens the average number of hens per flock was 132 hens The size of flock in the Midwest as shown by this survey was

Size of Flock	Per Cent of Families with Hens
Less than 50	24
50 to 149	39
150 to 299	26
300 and more	11

Table 12–1 Months in which chicks are purchased on midwestern farms

Month	Per Cent of Families Buying
January	1
February	5
March	25
April	38
May	23
June	4
July	1
August	1
September	*
October	*
November	1
December	1

* Less than 1 per cent Percentages based on 579 replies to the question, "During what months do you usually buy baby chicks? *Successful Farming* (1952)

Table 12–2 Total number of baby chicks hatched per month, 1952 *

Month	Total Replacement Chicks (thousands)	Total Broiler Chicks (thousands)	Total Chicks Hatched (thousands)
January	36,518	85,338	121,856
February	96,115	94,275	190,390
March	194 266	98,262	292,528
April	203,863	85,986	289,849
May	133,476	82 522	215,998
June	37,585	79,019	116,604
July	13,204	71,763	84,967
August	12 627	65,744	78,371
September	15,327	64,614	79,941
October	13,896	72,546	86,442
November	10,345	77,493	87,838
December	10,469	84,213	94,682
Totals	777,691	961,775	1,739,466

* Year-round characteristics of the poultry industry as evidenced by number of baby chicks hatched per month 1952 Total chicks hatched are from the Bureau of Agricultural Economics The division between broiler chicks and flock replacement chicks are Watt Publishing Co estimates based on government figures Courtesy Watt Publishing Co, Mount Morris, Illinois

4 Which kind of chicks would you prefer to buy of the following?

Ans 1 Pullorum Tested 25%
2 Bloodtested to zero reaction 23%
3 Pullorum Safe 19%
4 Pullorum Passed 13%
5 Pullorum Clean 12%
6 Pullorum Controlled 8%

5 Which kind of chicks do you prefer to buy of the following?

Ans 1 Bred To Lay chicks 44%
2 200–300 egg bloodline chicks 29%
3 R O P Sired 19%
4 Egg Laying Contest bloodlines 4%
5 Pedigree Sired 4%

From the results it is evident that midwestern farmers want chicks that will live and the kind that are Bred To Lay These points should be stressed in appealing to this type of customer As pointed out earlier, the breeding and flock improvement back of the chicks should support the advertising and sales claims made

It should be kept in mind that terms which are clear and mean something to the hatcheryman may have little meaning to the average poultry raiser who raises chickens only as a side line Therefore, the customer should be told of the quality of the chicks he will buy in terms that mean something to him Examples of this point are shown in the replies to questions 4 and 5 above R O P Sired breeding Pedigree Sired, and Egg Laying Contest bloodlines, all should produce chicks that are Bred To Lay, yet most farm people apparently chose the term "Bred To Lay" because it stated simply and understandably the thing in which they were most interested

Occasionally, a term gains acceptance in the trade which actually has no meaning yet is accepted by the customer as a true description of quality As an example of this, a survey made by a hatchery organization in 1948 showed a leading preference for "AAA grade chicks as follows

Ques Which grade of chicks would you prefer to buy?

Ans AAA grade 53%
R O P Sired 18%
U S Approved 11%
U S Certified 10%
Pedigree Sired 8%

These percentages are based on 519 farm families replying to the survey These families represent a cross section of subscribers with an estimated 110,220,000 hens

A similar survey conducted by a St Louis firm in 1952, covering much of the West North Central area as well as a cross section of southern states shows the following distribution in flock size

Number of Layers in Flock	Per Cent of Total
Under 100	47
100–300	35
300–1000	14
Over 1000	4

Several studies have been made in an attempt to find the appeals that interest the typical buyer of baby chicks Most of these studies have been made in the Middle West and reflect the desires of farm flock poultry raisers more than of commercial producers

A survey of farm poultry raisers made by *Chick Exchange*, a weekly service bulletin for hatcheries reported the following questions and replies

1 Which kind of chicks do you prefer to buy?

Ans Purebred 72%
Crossbred 18%
Hybrid 10%

2 Which would you rather have chickens that lay better, or chickens of better meat type?

Ans Chickens that lay better 75%
Chickens of better meat type 25%

3 *When you read hatchery advertising what determines your selection of the hatchery you write to for literature?*

Ans 1 Chick livability records 22%
2 Egg records of hens 16%
3 Bloodtesting 14%
4 Testimonials from satisfied customers 13%
5 Winnings at egg laying contests 10%
6 Profit records of hens 10%
7 National Poultry Improvement Plan supervision 10%
8 Special discount offer 4%
9 Other reasons 3%
10 Low prices quoted 2%

words, it is better to address "Boxholder, Rural Route #3" than to address simply "Boxholder, Rural Route" without giving the route number. Mail carriers get a great deal of this type of mailing, in fact so much that it sometimes becomes burdensome. The more complete the address, the more likely will the mailing get complete distribution.

One hatchery has reported the development of an effective mailing list through use of boxholder mailings. This hatchery selects towns on the map where delivery of chicks can be made and then makes test mailings to one route of each town selected. If returns are good for one route, this hatchery then makes mailings to the other routes of the town that gave good returns.

The Postal Guide printed by the United States Government Printing Office gives a complete list of the number of rural route boxholders for all United States post offices. A detailed list of the number of boxholders on each route can be supplied by the postmaster.

Door-to-Door Selling

One of the best means of selling local chicks is by direct door to door selling in the country. The initial cost of travel and time spent in visiting and selling may seem high, but sales of this type usually result in reorders year after year. It is almost impossible for any type of mailing piece to do as effective a job of selling as can be done through personal visits with the customer.

The salesman for the hatchery can drive through the country, calling on prospective customers, getting their name and address, the breed of chickens they raise, and their housing capacity. From this information, the hatchery can build up a card file index of old customers and new customer prospects. This card file should be complete with essential data concerning the customer and should be referred to by the salesman before he calls on the customer or prospect.

Some salesmen who sell chicks have made it a practice to call on farms that have brooder houses on the farm premises. A farmer with an empty brooder house is usually a good prospect for baby chicks in the spring months.

Almost every farm community has a "leader," a person who is successful and to whom the others in the community look for advice, guidance, and ideas of how they too can be more prosperous. The sale of chicks to a leader in the community can be a means of opening up many new opportunities for sales to others who are in the habit of following the leader.

In this study, the term "AAA," which has little or no meaning, was preferred apparently because hatchery advertising and claims had convinced the unobservant buyer of chicks that such chicks were best

In selling, the hatchery should attempt to tell the prospect the things he wants to know regarding the chicks offered These may not necessarily be the things that the hatcheryman thinks the customer should know The progressive hatcheryman is alert to note changes in chick buying preferences, and quick to make the necessary changes in his production and sales program to keep up with the changing times

SELLING CHICKS LOCALLY

The sale of chicks should logically begin at home Local sales can be most profitable because they usually require less selling and delivery cost. Newspaper advertising, radio advertising, and local boxholder mailings are helpful in convincing the local buyer that the chicks he buys at home are better than those he sends away for

Local Newspaper and Radio Advertising

In making up advertising for local newspapers or radio, it should be kept in mind that the local public is usually well acquainted with the local hatcheryman, his place of business, and reputation for fair dealing Since the local hatcheryman is well known, the mere fact that he has an ad is not going to create extra confidence

To get action and reader interest, the local ad should be changed each week if possible, and can feature special offers on merchandise such as feed equipment, and remedies Special offers on baby chicks are not particularly desirable locally, as local people soon learn that specials may be offered and wait, instead of ordering their chicks in advance

If it is not possible to change the ad each week, it may be possible to work up three to six different sets of copy and alternate them, so that the same ad does not appear in two consecutive weeks Give new and different reasons each week why your chicks are better

Boxholder Mailings

Boxholder mailings can be an effective means of getting the entire territory informed of special events or special offerings that the hatchery may have

When boxholder mailings are used, they should always be sent with the boxholder number on the address to get best distribution In other

of current interest such as the various holiday seasons can be worked out to continue to attract interest

Truck lettering can also be used effectively to create interest and sell the public on the quality of chicks produced by the hatchery One

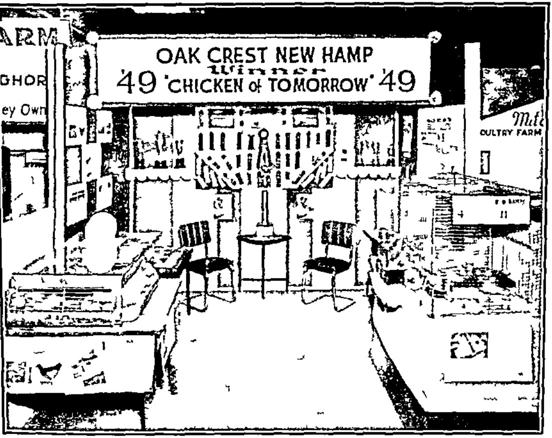

Fig 12-2 Display booths such as this tell the story of hatchery quality and serve as a means of contacting customers at special events such as fairs and conventions (Courtesy Oak Crest Poultry Farms, Jacksonville, Florida)

hatchery used the slogan Another Load of Those Good–Hatchery Chicks' on the back door of the truck Cars following the truck along the highway would be impressed with the volume of truck business being done, and car owners or their friends might thus be influenced to buy

Other Sales Ideas

Working with 4 H Clubs and Future Farmers of America groups is a means of interesting young people in poultry raising These young people are the future customers of our hatcheries The results of such a project are shown in Fig 12-1 The chicks for this project were supplied by the hatchery They were raised to broiler size and then

The hatchery may wish to employ more than one salesman. Often, salesmen who sell other merchandise are available to sell chicks. Such salesmen may be interested in selling chicks door-to-door on a part-time basis. These salesmen usually work on a commission basis, the commission varying depending on the grade and sex of the chicks sold. Commissions on pullet chicks would be slightly higher than for straight run chicks, as the dollar sale value is greater.

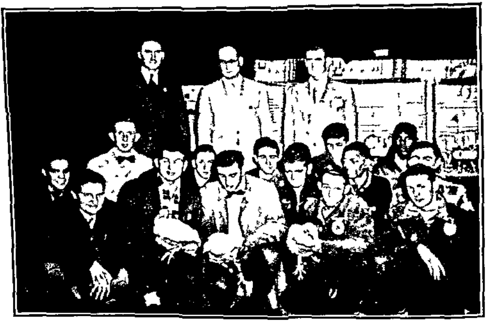

FIG 12–1. This group of Kennett, Pennsylvania, FFA members is shown with their winning entries in the 1951 Farm Show. (Courtesy Logan's Hatchery, Kennett Square, Pennsylvania)

Contests, with prizes, stimulate interest among salesmen and spur them on to greater sales efforts

Roadside Signs, Window Displays, Trucks

As with any advertising, it pays over a period of time to keep the name of the firm constantly before the public. Some hatcheries use roadside signs with the hatchery name, street address, and telephone number, with perhaps a brief slogan which identifies the hatchery and its product.

Window displays can be used to attract attention and favorable comment. At Easter time, some hatcheries display colored baby chicks and ducklings. One very attractive display featured colored ducklings and a pool of water for them to swim in. Ideas featuring some item

Price copy to be used in magazines issued monthly is difficult to work up, as copy must be submitted to the publisher several weeks in advance Conditions may change quickly, egg prices may advance or fall, and prices will then be out of line with competition or too low to be profitable

Some areas have weekly farm newspapers in which considerable price copy appears *Price ads in weekly farm newspapers bring good* returns, especially late in the season if prices quoted are lower than average If prices are higher than average, there will be practically no returns

An ad stressing quality alone, with no prices quoted, will bring very few inquiries in a publication where most hatcheries use price copy If quality copy is used in such papers, it should run early in January and February to attract the better buyers who get their chicks early

For a permanent type of business, it is best to stress quality in advertising and to attempt to get inquiries from persons interested in getting quality chicks There are many ways of getting inquiries, through offers of premiums and other devices, but such inquiries may prove to be a liability if the person inquiring is not interested in baby chicks but writes only for the purpose of getting the premium offered for the inquiry Mailings made to such inquiries waste money because they expend time, mailing material, and postage No amount of sales promotion will sell a person who is not equipped for or not interested in raising chickens

Selling Chicks by Mail

There have been more baby chicks sold by mail in a single year than any other item of merchandise This is an amazing record when we consider the multitude of items that are sold by mail

Names and addresses of people interested in buying chicks are obtained from advertisements in farm and poultry magazines It is also possible to rent lists of names of persons engaged in various types of agricultural occupations Mailings may be made to these rented lists in an attempt to sell them baby chicks However, the best prospect is the one who has written in, asking for information about your chicks No other hatchery or firm can obtain as high a rate of return from mailing to your own inquiry list as you can

The usual procedure in answering inquiries is to mail the inquiry a catalog or circular with price list and a letter which thanks the person for their inquiry and may call their attention to information contained in the catalog or circular that may be of particular interest

dressed out and exhibited in meat classes Competition among young people s groups serves to stimulate interest.

Another hatchery has worked with 4 H Club groups for several years training them in poultry and egg judging Interest created through an appreciation of the finer points of judging poultry may be carried over into adult life

In some areas, hatcheries have found it helpful to work with representatives of government lending agencies such as the Farm Home Administration Such agencies, as well as banks have their representatives in the field and are interested in stimulating agricultural development through loans The hatcheryman can often be of service in advising on housing requirements etc , and through this service may obtain some sales

Local fairs may give an opportunity for displays for the hatchery Such a display is illustrated in Fig 12–2 A registration for prizes will bring more visitors in for such displays However, the names if used for mailing should be screened carefully, as many of the names obtained through such registration will be of little value for mailings Many will register who are not interested in chickens

MAIL ORDER SALES

The theory and practice of mail order sales may stress the same points of quality as used in local selling but the approach is somewhat different. In mail order, you must create confidence in your hatchery and your product among people who will probably never see you or your hatchery Seeing your ad time after time will convince them that you are reliable and are in business to stay Therefore, it is often practical to use the same copy in your ads year after year if it is doing a good job of getting inquiries and business

Mail Order Advertising

Most mail order advertising is designed to get inquiries from persons who are interested in buying baby chicks

The actual selling of the chicks takes place in the answer to the inquiry and in the follow up mailings

Some hatcheries use price copy entirely in their publication advertising The experience of most hatcheries which have used price copy alone in advertising is that prices quoted must be relatively low to bring in any appreciable amount of business

Table 12 3 System of reply and follow up to inquiries received in December 1948

Hatchery	Was Catalog Mailed in Reply to Inquiry?	Number of Pages in Catalog?	Did Catalog Use Color?	Size of Catalog?	Followup				Interval between Followup
					#1	#2	#3	#4	
A	Yes (Dec 30)	48	Yes	9" x 12"	Dec 28 letter pr list	Feb 5 pr list	Mar 27 pr list	None	8 weeks
B	No				Dec 31 circular pr list	Jan 16 pr list	Mar 11 pr list	Apr 18 pr list	#1—2 weeks #2—8 weeks #3—4 weeks
C	Yes	32	No	7½" x 10½"	None	None	None	None	
D	Yes	32	Yes	8½" x 11½"	None	None	None	None	
E	Yes	24	2 color	7¾" x 10⅝"	Jan 6 pr list	Feb 13 letter pr list	Mar 20 pr list	None	5 weeks
F	Yes	24	Color on cover only	7¾" x 10½"	Jan 7 descriptive pr list	Mar 11 pr list	Apr 28 pr list	None	6 to 9 weeks
G	Yes (Dec 29)	24	2-color	7½" x 10½"	Jan 7 circular pr list	Feb 14 circular pr list	None	None	5 weeks
H	No				Jan 20 letter pr list	None	None	None	
I	No				Jan 1 circular pr list	Feb 20 letter pr list	Apr 14		8 weeks
J	Yes	28	2 color	8¼" x 10½"	None	None	None	None	
K	Yes (Jan 7)	32	2-color	7⅞" x 10½"	Jan 20	Apr 17			11 weeks

Some hatcheries practice a definite policy of following up on inquiries, and others mail to the inquiry list only when they feel they need orders for chicks It is usually not desirable to mail more often than at 4-week intervals With increased mailing costs, it would seem more practical to mail less often but to plan the mailings better so as to get the largest possible returns

A study (Table 12–3) made of one group of mail order hatcheries, and their method and system of replying to inquiries, showed that, of 11 hatcheries, 8 sent a catalog in reply to inquiries Three other hatcheries sent a catalog only in reply to the inquiry but did not follow up with any additional mailings later in the season One hatchery made 4 mailings at intervals of 2 to 8 weeks, 4 hatcheries made 3 follow up mailings at intervals of 5 to 8 weeks, and 1 hatchery made only 2 follow up mailings

In a survey made by *Hatchery and Feed* (1950), it was found that 4 out of every 10 hatcherymen use a catalog to promote their business, while 7 out of 10 use circulars, broadsides, folders, or other mailing pieces as a means of stimulating sales

This survey showed that January was the most favored month for catalog mailings, with 50 per cent of those using catalogs reporting that they mail in January February was the second most favored month, with 25 per cent of catalog users mailing then Seventeen per cent were mailed in December

Hatchery and Feed comments

> It would seem that many hatcherymen are somewhat lax in following through on their catalog mailings for 28 per cent, or more than one fourth of those who use catalogs, report they have no follow up mailings However, 14 per cent do use 1 follow up, 8 per cent use "1 or 2," 14 per cent use 2, 3 per cent use "2 or 3," 8 per cent use 3, 11 per cent use "3 or 4" 3 per cent use 4 or 5, 6 per cent use 10 or 11, and another 6 per cent use 12 follow ups

Although the *Hatchery and Feed* survey did not so state, it is probable that those using 12 follow ups sent approximately 4 each year and kept an inquiry name on the mailing list for 3 years before removing it

The older an inquiry name becomes before ordering, the less chance there is of selling that inquiry Most hatcheries keep inquiry names for 3 years If, at the end of 3 years, they have been unable to sell the inquirer through mailings, they remove the name from the mailing list.

All mailing lists should be kept up-to-date The hatchery should guarantee return postage on any mail which is undeliverable, and

sponsor a news broadcast or market report service as a means of reaching a large listener audience with the hatchery sales message.

Selling Chicks Wholesale

Many hatcheries and dealers buying quantities of chicks buy them at wholesale prices and sell them to their customers at a price that nets them a profit. Some hatcheries are definitely opposed to selling chicks at wholesale prices, as they feel that the margin of profit in selling baby chicks is too narrow to permit such sales.

Some hatcheries get a few orders during the off-season, and prefer to buy the chicks from some other hatchery rather than to try to hatch them. Other hatcheries may have an occasional order for a breed that they do not hatch, and then it may be advisable to get them from some hatchery selling chicks at wholesale prices. It is this type of hatchery which is interested in getting chicks at wholesale.

Dealers and stations which buy and sell poultry and eggs, or handle poultry feed, frequently find it profitable to sell baby chicks. They get the immediate profit from the sale of baby chicks and also have an opportunity to sell feed to the customer over a period of time.

PLANNING THE ADVERTISING PROGRAM

Some hatcheries have built a good business without a single line of advertising. These hatcheries have developed their business gradually over a period of years and have produced an exceptionally fine quality chick, which has resulted in a high per cent of repeat sales from satisfied customers.

To build a volume of business within a relatively short time, an advertising program is almost essential. To acquaint the buying public with your chicks, and why they are better than chicks from other hatcheries, an advertising program can be most helpful and result in increased business for the money spent.

The Advertising Agency

The services of an advertising agency should be enlisted if the advertising campaign is to be at all extensive. The agency can supply help on copy and art work, which will give the advertising the life and appeal it should have in order to bring in the highest inquiry return from quality buyers.

When advertising is placed with a publication through an agency, the rate paid to the publication is the same as if the advertising was

these names should be removed from the list The following imprint on the mailing piece will assure return if it cannot be delivered

Postmaster If undeliverable for any reason notify sender stating reason on Form 3547, postage for which is guaranteed

It is often desirable to do a certain amount of testing of different mailing pieces, and different pricing systems, such as prices with discounts and without discounts, to determine which method of mailing will pay best

The hatchery season for mail order chicks is relatively short, and insufficient time is afforded for adequately testing different mailing pieces It is advisable, therefore, to make test mailings in advance of the main season to give adequate time for analyzing returns

Test mailings should cover the same area and be made at the same time and under the same conditions to give the proper basis for comparison of returns To do this all the envelopes should be addressed, and then sorted one by one, into 2, 3, or as many groups as there are to be tests In this way, if the mailing list is filed alphabetically and geographically, it is possible to send three different test pieces to three different persons in the same town Each group of envelopes is stuffed with a different test mailing

Mailings should strive to stimulate action by offering a discount for orders mailed within a certain number of days or by a certain date Premiums can be offered in place of discounts on the same basis to get orders in If the mailing does not contain some good reason for ordering, it will likely be laid aside and forgotten

Selling Chicks by Radio

Radio can be used effectively to sell chicks either directly or by a quality approach to get customers into the hatchery during the spring buying season

If radio is used to sell chicks direct to the customer, a special offer must be made to get maximum returns Only a single offer can be made effectively on radio and the offer must be repeated in the copy so that the listener will understand it if his attention is aroused and he has not heard the offer the first time Repetition of sales points and particularly of prices is very important in selling by radio

A study should be made of the time when the most farm people will be listening Surveys in the Middle West have shown that during the winter and early spring months the majority of farmers listen from 6 A M to 7 A M and from 12 to 1 noon The hatchery may wish to

Others feel that it is more economical to limit the advertising budget in poor years when inquiries are hard to get, and they spend more in good years when inquiries are easier to get

Results from advertising are based on the cost per inquiry obtained, which is calculated by dividing the total cost of an ad by the total number of inquiries Some hatcheries project this further and determine the total dollar volume of sales from a particular ad This method may not give a good long range picture, however, as one particularly large order could affect the results

Advertisers with years of experience and a backlog of good paying ads will do considerable testing of new ads before using them extensively For example, if they have a new ad to try out, they will not try it in a new publication, on which they have no basis for comparison They will try it in an old publication first If it does well, they may use it more extensively Likewise, if they are trying out a new publication, they will use an ad that has been tried and tested previously and found to give uniformly high returns

The advertising agency has years of experience in solving such problems, and their help and advice should be sought

A final point in planning the buying of advertising space is the check on the circulation coverage of the publications to be used

For example, if the hatchery is located in the Midwest, and the magazine has a large eastern and Pacific coast circulation, it would be wasting money to advertise in the national edition The hatchery would be paying for circulation that it could not reach with shipments of chicks, even if it were able to sell them Many papers divide their circulation coverage into areas such as eastern, central and west, and southern editions Special rates are quoted for ads run only in these special editions It is wise to select a publication or an edition that has maximum circulation in the area in which the hatchery can most readily ship chicks

THE HATCHERY CATALOG AND MAILING PIECES

In doing mail order business, it should be kept in mind that the hatchery catalog and the various mailing pieces are the only contact the hatchery has with the prospective customer

Therefore, the first thing that any mailing should do is to attract attention, arouse interest, and make the prospect want to read every word Catalog covers that attract attention are shown in Fig 12–3

placed directly by the hatchery with the publication The agency will bill the hatchery at the regular line rates plus a charge for any extra art work or engravings necessary in the preparation of the ad

The advertising agency selected by the hatchery should have some experience in placing agricultural advertising and, preferably, poultry and hatchery advertising This is important, as an agency which is not familiar with the agricultural and poultry field will not be able to advise on the publications that give the best inquiry returns, and will not be able to assist with copy which has the necessary ring of sincerity essential for best results

Space Buying

In ordering advertising space, the magazines or papers selected are important Advertising in strictly poultry magazines may not bring as low an inquiry cost as advertising placed in national farm publications, but the per cent of closures, or people who finally buy, may be greater for inquiries from readers of poultry magazines, because they are definitely poultry inquiries

Publications with a heavy rural route circulation among farm readers are the best source of low cost inquiries

Advertising is figured on the basis of number of lines There are 14 lines to the inch 1 column wide An ad 1 column wide and 3 inches high would figure at 42 lines

It is necessary to study the ads in each individual publication to select the size of ad that will assure good display position Some publications have a predominance of display type ads, some are predominantly display classified, and some carry considerable lineage of strictly classified ads There is usually good reason why most advertisers in a given publication have selected a certain type of ad They have found through trial and error that this particular type of ad pays best in this particular magazine

It is always a problem to determine just how much money should be spent on an advertising campaign The advertising agency can give helpful advice on this matter A study of the advertising budget of several leading advertisers would indicate that an annual budget of 1 to 2 000 dollars per 50 000 egg capacity might be effectively spent to give reasonably low cost returns

Some advertisers spend more money for advertising in a poor year, on the theory that increased advertising will bring more business

or customers, or choice and prize winning birds or pens owned by the hatchery The prospect is interested in facts and figures that show why the hatchery's chicks will do a better job for him

Testimonials from satisfied customers are always interesting to the reader Either an exceptionally good testimonial, illustrated with a photo of the customer and his birds, or a great many short testimonials can be used effectively Testimonials are one of the oldest and still one of the best means of convincing the prospect of the kind of results he can expect

Hatchery Mailing Pieces

Broadsides, circulars folders, price lists, and letters make effective mailing pieces In planning printed material, the hatchery should get the advice of the printer on sizes that will cut out most economically, and save money in preparation

Art work gives attractiveness to any mailing piece and gives emphasis to the main selling points in any advertising The advertising agency or the printer may have an artist who can help in making attractive layouts from the rough sketches supplied by the hatcheryman

Colors arouse interest, attract attention and if properly used may actually stimulate action according to color engineers who have studied the problem A red color is the best for stirring the prospect to action A combination of red with yellow or other colors gives an attractive 3 color combination for printing broadsides and circulars

Copy should be written so that each sentence taken individually means something to the reader The reader should not be required to read through a maze of material to find the meaning of some stray statement in the copy In any copy, the lead off statement should tell the prospect something in a few words that he can understand, and something that is going to arouse his interest For instance, state at the beginning of your mailing letter, Order our chicks in 10 days and get $1 00 per 100 discount for orders booked now for delivery any time before April 1st" Don t start off with a vague statement such as, 'We are writing to advise that we will again be hatching baby chicks this year

Any special offer should be at the start of the letter and not buried deep in the copy where it is difficult for the reader to find Make the lead off statement tell the customer why he should act now, and you have taken a big step toward arousing the prospect's interest so that he will read the remainder of the letter

Fig 12–3 These catalog covers attract attention the first step in selling the prospect for mail order chicks (Courtesy Stewart Simmons Co, Waterloo, Iowa)

The Hatchery Catalog

The hatchery catalog describes the hatchery's operations and offerings of chicks in detail The catalog design and art work should, as far as possible, reflect the personality of the hatcheryman, his family, and his employees To achieve this end, it is often desirable that the hatcheryman write as much of his own copy as practical Even though his own copy may not give the most interesting presentation, it will in great degree reflect his personality and give his catalog and mailing pieces a personal touch that no one else can give

One hatcheryman, commenting on this in *Hatchery and Feed* (1950), writes,

> In preparing our catalogs and broadsides, we get some help from an advertising agency on the art work and layout, but I write my own copy and supply my own photographs It seems to me that selling chicks is a good deal like selling life insurance and is the type of selling in which personalities are much more important than is true in selling some other types of merchandise By writing my own copy, I think we get into it more direct and personal appeal than is true if we let someone else write it

One of the easiest ways to tell the hatchery story effectively and with few words is to use good pictures Good pictures can show the hatchery, the owner and family, choice flocks owned by the hatchery

13

Organization of Work in the Hatchery

The efficient organization of work in the hatchery can do much to make the work easier, more enjoyable, and more profitable

Labor is the second greatest item of expense in the hatchery, second only to egg cost, and if the hatchery is to get the maximum efficiency from labor it must manage efficiently, use good equipment that does not require constant attention, and arrange the hatchery efficiently to cut down on unnecessary steps in the handling of a job

HATCHERY PERSONNEL

The kind of help a hatchery hires can be very instrumental in the success or failure of the hatchery Good help is an asset to any business, particularly so in the hatchery, and poor help is just the opposite Hatchery labor requires a certain versatility on the part of the worker, a willingness to learn, and the ability to see things that need doing

Most hatchery employees at some time or other are required to deal with the public If they are eager to serve, pleasant in their approach to the customer, they can be very helpful in gaining new business and winning new friends

Many hatchery workers prove unsatisfactory chiefly because they do not understand what they are supposed to do Frequently, they are asked to go to work told to do a job, but given little inkling of how that job is best performed One of the most successful means of explaining a job is to use a form outline, giving the chief points for a particular job and the best ways to accomplish it Such an outline, if gone over verbally with the worker, explaining each point, and then giving the worker a copy to read and think about later, after he has been on the job awhile, will do much to improve labor efficiency

It is not advisable to include too many pieces in a mailing The usual type of mailing may include (1) a letter, (2) a price list, (3) a descriptive circular, and (4) a return envelope Special offers or late market news that would influence the buyer's planning may also be included The weight of the mailing should be checked before final preparation as it may be too heavy to be mailed at the minimum rate

Good mailing practice involves planning the preparation of the mailing material well in advance of the season, mailing according to plan, and using inducements for prompt action that arouse the reader s atten tion Mailing pieces are not usually kept around the average house hold, and unless there is some reason for the prospect to act that is, to order, within a short time the mailing piece may be soon lost or thrown away

Federal Trade Commission Rules

The Federal Trade Commission promulgated Trade Practice Rules for the Baby Chick Industry in 1938 These rules were revised and brought up to date in 1948 The rules are directed to "the maintenance of free and fair competition in the industry and the elimination and prevention of unfair methods of competition deceptive practices and trade abuses To this end various unfair and deceptive trade practices are defined

The purpose of the fair trade practice rules and the main point stressed throughout the 21 pages that make up this book are given in Rule 1, Misrepresentation of products which reads, it is an unfair trade practice to make or publish or cause to be made or published directly or indirectly any statement or representation which is false misleading or deceptive in any respect" The hatcheryman who will be engaged in any considerable amount of advertising should become familiar with these baby chick industry rules

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Good help is not always the cheapest, and the highest priced help is not always best. Hire the person who in your opinion will work hard, appears intelligent, and then instruct that person in his or her job. Pay that person a fair wage so that he will have a real interest in his work and will stay with you, and you should have efficient labor if managed right.

RECEIVING EGGS

Eggs are brought into the hatchery by flock owners who deliver direct, by trucks that pick up eggs at the farm in some localities, or by trucks that pick up eggs at egg stations in nearby towns. Some hatcheries have all their eggs shipped in by rail or by truck and do not attempt to maintain flocks of their own.

Regardless of the manner in which eggs are brought into the hatchery, they must be accounted for, paid for, and grouped by breed and grade, ready to be trayed for the incubators.

Egg Delivery Record

Each flock owner should be supplied with some type of egg ticket which they should be required to put in the case when eggs are delivered. This ticket should show the name and address of the flock owner, the breed and grade, and the number of dozens of eggs in the delivery. Figure 13-1 shows a rather complete type of ticket which is available to hatchery members of the American Poultry and Hatchery Federation at its executive offices in Kansas City, Missouri. It will be noted that this ticket gives instructions to flock owners regarding the care of hatching eggs as well as the more pertinent information of flock owner's name and breed delivered. A good feature of this ticket is the item marked "No Eggs Rejected." Flock owners for most hatcheries are required to bring only good hatching eggs, which will meet the necessary requirements of egg size, shape, and cleanliness. Those who bring more than a set maximum of cull eggs have those culls charged back to them and receive only market price for eggs that cannot be used, it may, however, be desirable to return the cull eggs to the flock owner. This is helpful in that the flock owner can see what kind of eggs should not be brought to the hatchery.

What is considered "too many" cull eggs in a delivery to the hatchery? That is largely a matter of opinion. Some hatcherymen feel that there should be absolutely no culls in any delivery. This may be too strict inasmuch as there is some difference of opinion of what makes a cull hatching egg and it is also very easy to overlook some defects

HATCHING EGG DELIVERY RECORD

Flock Owner's Name ... .

Breed .. . . Date . .

Instructions to Flock Owners Concerning Hatching Eggs

Great care must be given to eggs that are to be hatched Handle carefully—do not bump or jar them They must not chill They must not lie in the sun They should be gathered twice a day (and oftener in cold weather), and kept in a cool, not too dry place After an egg is 5 days old it declines rapidly in hatchability.

Sort out all odd shaped, dirty, small, irregular, checked and rough eggs Tap eggs gently to make sure they are not cracked Do not wash eggs We do not want cracked small or irregular shaped eggs, neither can we use dirty eggs.

Pack eggs in case with small end down — be sure and fill every pocket and every layer in the case and turn egg case daily

Hatching eggs must be delivered at least once each week

Form 372 - Printed in U S A

DUPLICATE: Hatchery Record

	DOZENS	PART DOZ
No Eggs Delivered		
No Eggs Rejected		
No Eggs Purchased		
Price Per Doz		

Amount Paid ....

Eggs Trayed ....

Chicks Hatched ....

Hatchability ....%

By..........

FIG 13–1 Hatching egg delivery ticket This ticket with name, address, and number of eggs delivered should be filled in by the flock owner and enclosed in the case with each egg delivery Duplicate ticket is used for payment by office, and remaining information, 'No Eggs Rejected," etc, is filled in by the hatchery. (Courtesy American Poultry and Hatchery Federation)

such as slight checks or cracks, ridges, or rough shells Some hatcheries feel that the number of cull eggs should not exceed 5 per cent, or not over 18 cull eggs per 30 dozen cases Any cull eggs over this number are charged back to the flock owner, allowing only market price for the eggs or hatching egg price less the premium paid if the base price is different than the market price

GREAT PLAINS HATCHERIES

Date________________________________

Name________________________________

Breed________________ Grade________________

No Doz________________________________

REMEMBER: Put date eggs are delivered This ticket must be in case when you deliver eggs

FLOCK OWNER NOT TO USE SPACE BELOW

CULL EGGS LISTED BELOW

Culls and *Small Eggs*________ Tinted *Eggs*________ *Short*________

FIG 13–2 Another type of egg delivery ticket This hatchery uses red colored tickets to identify broiler type eggs yellow tickets for key flock eggs and white tickets for eggs from production bred flocks (Courtesy Great Plains Hatcheries Effingham Illinois)

Some hatcheries may wish to hatch and identify different types of chicks being produced in the same hatchery Then it may be advisable to use egg delivery tickets for flock owners which are of different colors so that they may be readily recognized by workers sorting eggs in the hatchery For example one hatchery (Fig 13–2) uses red colored tickets to identify its broiler type eggs a yellow ticket for key flock eggs and a white ticket for eggs from production type flocks

Checking In Egg Deliveries

When eggs are received at the hatchery the number of dozens should be checked to see that the number in the case corresponds with the number shown on the delivery ticket The ticket is then

initialed by the receiving hatchery employee, and a duplicate of the egg ticket is forwarded to the office where the flock owner is paid for the eggs delivered.

Some hatcheries follow the practice of paying for each week's delivery of eggs the week following their delivery. This plan works very

Hatching Egg Invoice

No.________

GREAT PLAINS HATCHERIES

Customer's Name	No. Cases	Kind of Eggs	No Doz.	Price	Total Paid	
TOTALS Cases Picked Up					Cases Left	

Date________ Dealer________ Address________

Driver Sign________ GREAT PLAINS HATCHERIES

FIG. 13-3 Hatching egg invoice form used by egg buying station. Eggs received at the hatchery are checked in against the names, breeds, dozens, and price shown on the invoice (Courtesy Great Plains Hatcheries, Effingham, Illinois)

well and makes it somewhat easier to charge cull eggs back to the flock owner, as there is sufficient time to grade the eggs and figure out the difference between the good and cull eggs delivered before final payment is made. Hatcheries which have been accustomed to paying cash for eggs on delivery may find it difficult to change to this delayed method of payment.

When eggs are picked up at egg stations in nearby towns and delivered to the hatchery, careful checking is again required. It is possible for either the flock owner or the station manager to make a mistake in entering the number of dozens of eggs or the price. A form used for egg station deliveries is shown in Fig 13-3.

The egg station invoice should be checked carefully as eggs are brought in on the trucks, to see that each flock owner listed and the number of dozens shown are accounted for. Egg stations usually work on a commission basis, getting a fee based on the number of dozens of eggs purchased. The commission based on the total day's receipts for the station may be figured on the station egg delivery invoice.

With very large egg stations, it is frequently advisable to make up special invoice pads for each station, listing the flock owners for that station alphabetically, with the breed and grade for each flock owner. This helps in checking in eggs, since, when flock owner names are written in by hand, and in a different place each week, it is very difficult to locate them. Having names listed alphabetically makes them easy to locate. The special printed form also has the advantage of making it easy to check on flock owners who miss an egg delivery for any reason. If the flock is ailing and out of production, this fact is readily noticed and can be ascertained and corrected.

EGG ROOM ORGANIZATION

Some hatcheries have a separate room for receiving and traying eggs, but perhaps the majority of hatcheries do not have such a room.

Regardless of location, the room area where eggs are received and set up for the egg trayers should be organized to make the work easier and to reduce errors to a minimum.

If several breeds of eggs are being received, it will help to have the egg room floor marked off (Fig 13-4) into rectangular areas the width of a 30 dozen egg case and as long as is needed to hold the number of cases of eggs in each breed that are normally received for any one setting. These areas should then be marked with the breed name, and all cases of eggs of each breed should be placed in their proper places on the floor. With such a system, eggs of a given breed are all together and are in the same place week after week, so that they do not have to be hunted for. When egg inventory is taken, the number of dozens by breeds can be checked readily without unnecessary moving of cases.

FIG. 13-4. A well-arranged hatchery interior. Note the markings on the floor to the right. These serve the dual purpose of segregating the chicks by breed when taken from the incubators and in keeping the cases of eggs separate. Egg traying table is to the right of the area shown. (Courtesy Superior Hatchery, Windsor, Missouri.)

Traying of Eggs

In handling eggs throughout the hatchery, it should be kept constantly in mind that we are dealing with the most costly item in producing baby chicks. Anything that can be done to cut the cost of eggs will aid materially in reducing the cost of chicks produced. Egg traying is an important function in the handling of eggs through the hatchery. Much can be done at the traying table to reduce egg breakage, to account for eggs by breed correctly, which is essential to good sales organization, and to improve hatches.

The following are instructions given by one hatchery to their egg trayers:

1. Mark egg trays with the correct breed and flock owner's name. Use correct grade tickets on trays.
2. Set eggs with large end up, and pack trays carefully so that eggs will not fall over on sides or be otherwise out of position. Use paper or excelsior for packing trays.
3. All cull eggs over 18 per case are to be charged back to the flock owner. Flock owners are furnished with egg scales and are required to cull out all ridged, rough, or very dirty eggs, or those otherwise unsuitable for setting.

4 Eggs that are extremely large or extremely small should be culled out Extremely large eggs do not hatch well and extremely small eggs hatch small undersized chicks

5 Be sure when trays of eggs are mixed (which may be necessary when using the last eggs of a given breed) to use eggs that will hatch chicks of a different color

6 All ridged eggs and eggs with cracks should be culled out Tinted (*creamy colored eggs*) *in White Leghorns should be culled out*

7 Use *both hands* in traying eggs

8 *Some find it best to remove the cull eggs from the case as they lift* the filler out In that way they don t have two good eggs in the hand and then have to pick a cull egg out of the tray

9 Fill empty cases with *good* fillers and flats If cases need repairs set them aside so they will be repaired before going back to stations or flock owners Good cases are essential to prevent breakage and improve hatches

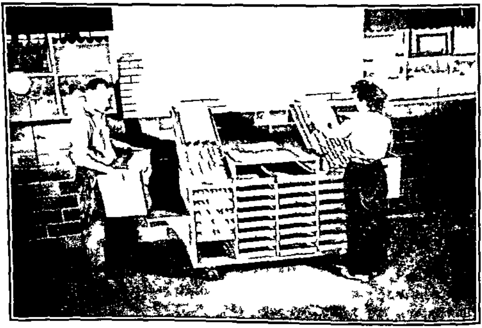


Fig 13–5 Egg traying Note that here the tray cart serves both to hold the filled and empty trays and as a traying table complete with a bench for the full cases on each side (Courtesy Indian River Poultry Farms Lancaster Pa)

Eggs should always be trayed in such a manner that they are held tightly in place, so they will not drop out when the tray is tilted at a sharp angle when it is automatically turned in modern incubators Eggs that are loosely packed in a tray may not hatch as well as those that are properly trayed particularly if they are so loose that the egg can slip over on the side or with the large end down Eggs can be

held tightly in place by packing the end of the tray with paper or excelsior. If the plan is to set only a part of a tray, some incubators supply a metal bar, which hooks into the bottom of the tray and serves as a false end, and the eggs are then trayed and packed, in the same manner as with a full size tray.

Most egg traying tables are built so that the trays can be held at an angle while being filled with eggs. In this operation, the tray carts which hold the eggs until they are wheeled into the incubator room for setting are separate from the traying table. Some hatcheries (Fig. 13-5) use the tray cart and traying table combined, which works very well. Traying in a different type setting tray is shown in Fig. 13-6.

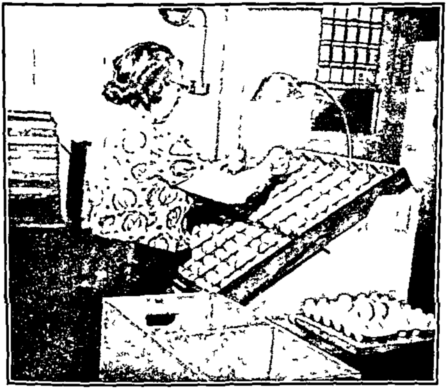


FIG 13-6. Traying hatching eggs at Mt Vernon Plant, Western Cooperative Hatcheries

Hatcheries have different methods of accounting for the number of eggs set. One hatchery setting several different breeds and crosses requires the trayers to count the eggs in each tray and enter the number in the tray on a card fastened to the end of the tray (Figs. 13-7 and 13-8). Before setting, the number of eggs shown for each tray is entered by breeds and grades on a work sheet and is then sent to the office to be transferred to the setting report.

4. Eggs that are extremely large or extremely small should be culled out. Extremely large eggs do not hatch well, and extremely small eggs hatch small undersized chicks.

5. Be sure when trays of eggs are mixed (which may be necessary when using the last eggs of a given breed) to use eggs that will hatch chicks of a different color. . . .

6. All ridged eggs and eggs with cracks should be culled out. Tinted (creamy colored eggs) in White Leghorns should be culled out.

7. Use *both hands* in traying eggs.

8. Some find it best to remove the cull eggs from the case as they lift the filler out. In that way, they don't have two good eggs in the hand and then have to pick a cull egg out of the tray.

9. Fill empty cases with *good* fillers and flats. If cases need repairs, set them aside, so they will be repaired before going back to stations or flock owners. Good cases are essential to prevent breakage and improve hatches.

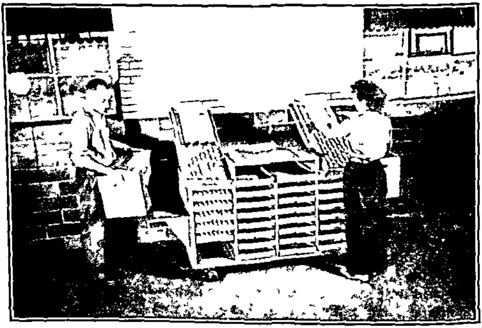


FIG 13–5 Egg traying. Note that here the tray cart serves both to hold the filled and empty trays and as a traying table complete with a bench for the full cases on each side. (Courtesy Indian River Poultry Farms, Lancaster, Pa.)

Eggs should always be trayed in such a manner that they are held tightly in place, so they will not drop out when the tray is tilted at a sharp angle when it is automatically turned in modern incubators. Eggs that are loosely packed in a tray may not hatch as well as those that are properly trayed, particularly if they are so loose that the egg can slip over on the side or with the large end down. Eggs can be

Egg Holding Room

Occasionally, it is necessary to hold hatching eggs in the hatchery for 2 or 3 days before setting In such cases, it is desirable to have an egg holding room in the hatchery which maintains the temperature at 55 degrees, apparently the most favorable temperature for holding eggs for hatching before incubation

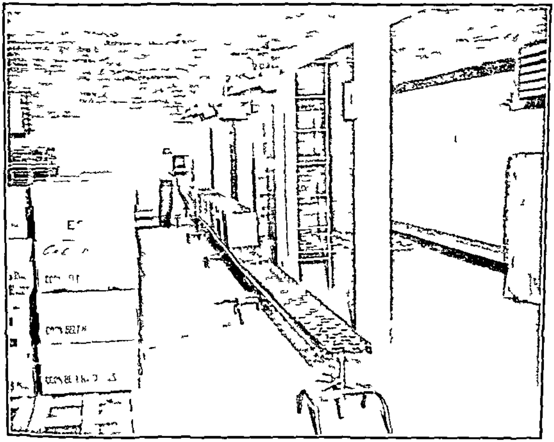


Fig 13–9 Modern scientifically designed egg holding room This room holds the temperature at 55° and the relative humidity at 85% Capacity of the room 1,000 cases of eggs (*Courtesy Corn Belt Hatcheries, Joliet, Illinois*)

Some hatcheries have solved this problem by attaching a cooling unit to an old incubator hull, using it as a walk in type cooler Such coolers are very valuable particularly during the hot summer months, when egg quality goes down fast if eggs are held at room temperatures Some hatcheries operating the year around have built special egg cooling rooms for holding eggs Such a room is shown in Fig 13–9 This room keeps the relative humidity at 85 per cent and the temperature at 55 degrees, thus supplying ideal conditions for holding hatching eggs by all present day known standards

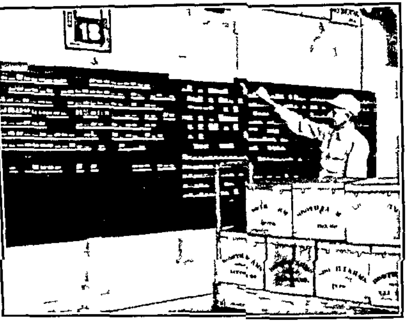


FIG 13-7 A supply of tray cards bearing the name address breed and grade of each flock owner is made up for the season and these cards are kept in the rack shown above ready for use in identifying the flock owner s eggs when trayed (Courtesy Booth Farms and Hatchery Clinton Missouri)

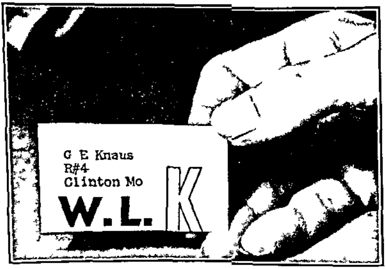


FIG 13-8 Close up of tray card used at Booth Farms and Hatchery Clinton Missouri Card shows name address breed and grade A season s supply of these cards is imprinted for each flock owner

If chicks are to be shipped by rail, the two weeks preceding Christmas should also be avoided There is so much parcel post to be handled at this time of year that baby chick shipments do not move through at their normal rate of speed As a result chicks may reach their destination in poor condition because of unavoidable delays en route

Chicks being hatched for the broiler trade are also best hatched early in the week Most broiler chicks go to farm growers, who have become accustomed to doing their weekly trading in town on Saturdays, and they do not like to stay home on the weekend waiting for a load of chicks to arrive

When the hatching days are selected, and the eggs are being set in the machines, all precautions should be taken to handle the trays of eggs carefully to avoid cracking or breakage

Trays set in the incubators should be checked carefully to see that the ends are pushed in as far as they will go Frequently, in some types of incubators, if trays are left partly out, the trays become crushed by the automatic turning mechanism when it starts operating

INCUBATOR OPERATION

Good incubator operation can improve hatches by several per cent over poor operation and increase profits correspondingly It is frequently observed that a new man can come into a hatchery which has been getting mediocre hatches and that he will immediately get increased hatches simply by doing the 'little things essential to good hatches

Taggart (1952) emphasizes the importance of good operation as follows

> If your chicks cost 14 cents each and you lose 5 000 by some operation failure, you have lost $700 00 Furthermore, you will have to sell 23,334 chicks at a 3 cent profit each to offset that loss To make money, hatches must be uniform, not good one week and off somewhat the next

A good incubator operator who takes the time to see that the incubators are supplying all the essentials for good incubation can get good hatches even from old, used equipment Taggart (1952) writes,

> let us assume that any standard make incubator will give a good percentage of hatch in the hands of an operator who understands the equipment and is willing to give it the attention necessary To illustrate A few years ago I visited a hatchery that had 150 000 capacity of incubators of a model that was no longer being made The trade looked upon it as a "lemon," but the

Setting Eggs

The time and manner of setting should be gauged by the times best suited to rail or truck delivery of the chicks to customers

Eggs which have been held in cool holding rooms should be brought out soon enough to allow them to warm up to room temperature before they are put in the incubator Setting cold eggs places a burden on the heating elements of the incubator by forcing them to work overtime to bring the incubator temperature up to normal Cold eggs set without a warming up period will hatch slower than estimated and may cause a delay in delivery of chicks to customers

For shipments of chicks by rail, Sunday, Monday, Tuesday, and Wednesday of the week are the best shipping days Since most people do not wish to work on Sunday, the first three days of the week are left as the only really good rail shipping days

Most hatcheries set their incubators twice weekly, for example, if the first hatch of the week is on Monday, the second hatch of the week in the same incubator will be on Thursday Or if the first hatch of the week is on Tuesday, the second hatch is on Saturday If a large number of incubators are being set it might be advisable in dividing up the work load to set one group of machines to hatch on Monday and Thursday, and a second group of incubators to hatch on Tuesday and Saturday Thus the hatchery would be hatching four days a week, Monday, Tuesday, Thursday, and Saturday, from two groups of incubators

It should be kept in mind in planning settings that the post office will accept only shipments going beyond the second postal zone on Saturday Chicks shipped to a nearby destination on Saturday will arrive on Sunday and frequently must be held in an unheated or otherwise uncomfortable place Losses may occur owing to improper holding conditions at destination on a day of the week when no one is working In the same way, long distance shipments to the fourth and fifth zone cannot be accepted on Thursday as the chicks arrive too late on Saturday to be delivered on rural mail routes All these points should be considered and checked with the local post office authorities before a setting and hatching schedule is definitely set up

Hatches on holidays or just preceding holidays should also be avoided as the post office cannot accept shipment of chicks which will reach their destination on a legal holiday, since usually there will be no one on duty to take care of the chicks on arrival

trays, because of either faulty traying or careless hand turning of eggs if machine is not equipped with automatic turning device

9 Fertility should be frequently checked Tray cards of poor hatching trays should be removed, and these poor hatching flocks should be visited at once to determine the cause of the poor hatch

10 Check on the cleaning of the machine and fumigation procedures See that the complete fumigation schedule is being carried out

11 Check temperature, humidity and turning at regular intervals (See Fig 13–10)

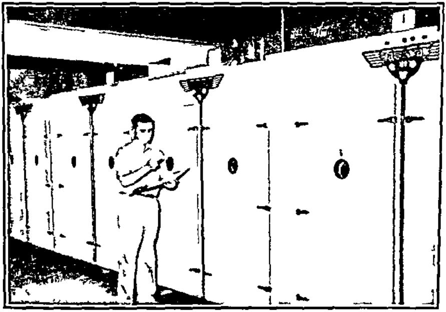


Fig 13–10 Checking temperatures on a line of incubators Checking of temperature, humidity, and turning should be done at regular intervals (Courtesy Western Cooperative Hatcheries Mt Vernon Washington)

Incubator Operating Records

Records of temperature humidity, turning and the number of trays of eggs set in each incubator are helpful particularly where several employees are doing the operating Such record cards are shown in Figs 13–11 and 13–12 The temperature humidity card shown requires the entry of the dry bulb thermometer reading for temperature and the wet bulb reading for humidity every 30 minutes In addition, the tilt of the trays is indicated by the proper diagonal mark Where several incubators are operating it is important to know that the automatic turners are actually operating Sometimes it is found that incubators have gone several days without turning and it was not discovered until hatches started dropping Some system of checking the tilt of the trays would have avoided this trouble, and it could have been immediately corrected before any damage occurred

owner was getting splendid hatches, and I wanted to find out how he was doing it On each of several visits I found he was doing the little things necessary to make up for the shortcomings of the equipment Every twenty *to thirty minutes he* checked each incubator and generally made some adjustment on the temperature, the air intake, or the moisture In contrast, I know of other plants that produced even better hatches yet only checked their incubators twice a day, and then seldom made an adjustment Most hatcheries are somewhere between these extremes The extra checking of the first plant was necessary because of the construction of the incubator, the air streams, and the arrangement of the eggs, were not balanced, and the controls were definitely second grade The right combination of these factors makes it possible to maintain the proper embryo temperature *without* overheating and that is what you should have

Checking Incubator Operation

Those in charge of incubator operation should read the operation manual for the particular make of incubator being used and see that instructions are being followed It is a common occurrence in checking machines for faulty operation to find operators doing something that is not called for in the operation manual Such practices, which are often started for some unknown reason, may actually be harmful to proper operation of the incubator

Some points to check that will apply to almost any machine, regardless of manufacture, are as follows

1 Doors on machines should fit tight If you can feel warm air escaping around the door edges when the machine is operating use rubber or felt weather stripping material to prevent these leaks

2 If machine is type using curtains, they should be checked to see that they are in good repair and cover the eggs in the incubating columns

3 See that heaters, ducts, etc , are free of down and dirt Accumulated down can often reduce efficiency of operation to the point where the machine will not maintain the correct temperature or humidity

4 See that cooling and humidifying sprays are actually working at all times In some localities with very hard water it is necessary to take off spray nozzles and immerse them in acid at least once a week or oftener to keep them free of mineral deposits found in hard water

5 Fan blades should be cleaned after each hatch Blades should be clean of accumulated down and dirt

6 Water bottles should be kept filled and wicks pulled up on humidity thermometers Wicks must be clean at all times and changed regularly to avoid faulty wet bulb readings, which occur when dirt or mineral deposits accumulate on the wick

7 Check all air intakes and outlets on the incubator to see that they are properly regulated

8 Eggs should be trayed tightly to avoid breakage of eggs falling from trays Look under turning racks to see that eggs are not being lost out of

The setting card shown in Fig. 13–12 carries a record of the number of trays of each breed and cross breed in the incubator and the grade. This card is placed in a metal holder on the front of the incubator by the door. The card for the last setting is placed at the top of the list, and the card for the setting that is ready to hatch is at the bottom. As each hatch is taken off, the card is removed, and the other cards move

SET	LOWER				HATCH
	GRADE				
BREED	Rops	Best	Spec	Std	NO. TRAYS
WL					
BR					
WR					
SCR					
WW					
NH					
WLxWR					
AUSxW					

Fig 13–12 Incubator card for record of breeds and grades set, date set, date to transfer to hatching compartment, and date to hatch This card record is placed in a holder on the front of the incubator (Courtesy Colonial Poultry Farms.)

down one space in the holder. By using this card, it can be immediately determined when the trays are to be placed in the hatching compartment, and when chicks are taken off. The operator can determine, without going into the machine or opening it, what breeds and grades are hatching in that particular incubator.

Instructions for Operating Machines

All incubators have definite operating instructions. These instructions should be followed to the letter for best results, as the manufacturer through years of experience and experimentation has evolved the best system for operating his particular incubator.

For new men, without training, who come into the hatchery to work, during the relatively short rush season experienced by hatcheries sell-

Colonial Poultry Farms

SEE THAT CURTAINS ARE IN PLACE

	TEMP	HUM		TEMP	HUM		TEMP	HUM
8 00			4 00			12 30		
8 30			4 30			1 00		
9 00			5 00			1 30		
9 30			5 30			2 00		
10 00			Turn Eggs 6 00			2 30		
10 30			6 30			3 00		
11 00			7 00			3 30		
11 30			7 30			4 00		
Turn Eggs 12 00			8 00			4 30		
12 30			8 30			5 00		
1 00			9 00			5 30		
1 30			9 30			Turn Eggs 6 00		
2 00			10 00			6 30		
2 30			10 30			7 00		
3 00			11 00			7 30		
3 30			11 30			8 00		
			Turn Eggs 12 00					

NOTE HERE ANY UNUSUAL CONDITION IN INCUBATOR

FIG 13–11 Incubator card for recording temperature and humidity (Courtesy Colonial Poultry Farms, Pleasant Hill, Missouri.)

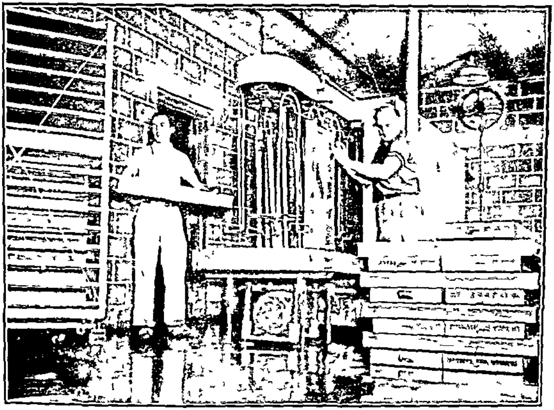


FIG 13-13. Washroom in Hubbard Farms Hatchery at Walpole, N H. (Photo courtesy Hubbard Farms)

hatcherymen owe their success not to "the touch" but to their unfailing regularity and attention to details. Bear in mind that each 24 hours represents about 5 per cent of the success of the hatch of chicks, for in 21 days the job is done. You cannot "make up tomorrow" what "you failed to do today."

"*Taking Off*" *the Hatch*

Chicks should be removed from the incubator as soon as 80 to 90 per cent of the trays are filled with fluffy, vigorous looking chicks, which have completely dried.

If chicks are removed from the incubator too soon, before the bulk of the hatch is ready and dried and fluffed out, the hatch may be reduced somewhat, and the chicks later taken out will be longer in getting the soft, fluffy down that is typical of the well-hatched chick. The animal heat given off by the chicks at hatching time seems beneficial to getting good hatches of properly fluffed chicks.

On the other hand, leaving the chicks in the incubator too long will tend to dry them down too much, and they will lose some of their vigor and vitality by being overexposed to the high incubator temperature.

ing flock replacement chicks during the spring months, it may be advisable to work up a brief instruction form, which summarizes the instructions given in the operating manual and gives any additional information that the hatcheryman has found helpful under his conditions It may include information such as the following (the information may vary dependent on the manufacture of the incubator being operated)

1 Clean spray nozzles once each week Designate a certain day for this job such as Friday of each week (Some hatcheries use muriatic acid in which to immerse these nozzles The acid removes the hard mineral deposit)

2 Keep machine operating at correct temperature and humidity at all times Do not attempt to change control settings without the supervision of an experienced person

3 Be particularly careful in transferring eggs from setting to hatching compartments Jarring or breakage at this critical stage will result in a lowered hatch

4 Clean fan blades, fan guards, and cooling coils *after each hatch,* as these elements influence the correct operation of the machine

5 Have a regular hour for setting the incubators Eggs will hatch in less time in the late spring when the outside temperature is higher, and an adjustment in setting time must be made to take into account this difference

6 If setting several incubators at once, keep the white shelled eggs in separate machines from the brown shelled eggs White shell eggs appear to hatch earlier with less moisture under otherwise identical operating conditions Also, there is less risk of getting Leghorn chicks mixed with white or white cross heavy breed chicks

7 Do not hold eggs on the egg room floor at room temperatures, as old eggs do not hatch as well as fresh eggs

8 Each hatch is to be fumigated with formalin on cheesecloth, fumigating twice during the hatch and before at least 75 per cent of the chicks are hatched Fumigating chicks that are too dry may cause respiratory damage, causing the chicks to gasp and the eyes to water

9 Do a good job of cleaning machines after each hatch Dry or steam clean trays free of all foreign material that may be adhering to trays, disinfect, or steam sterilize trays (See Fig 13–13, which shows automatic tray washing)

10 Keep ducts flushed out and clean

11 If there are water leaks in the machines or in the connections, find the cause and correct it

The importance of good incubator operation is well summed up in the following from the Jamesway Operating Instructions

> There is no black magic to incubating and hatching eggs It is true that some operators are more successful than others in bringing out large numbers of the best quality chicks Some hatcherymen are said to have "just the touch" to get best results, but the close observer will discover that these

chines, transferring the chicks to boxes right in the incubator, as is shown in Fig. 13–15. These methods seem equally effective in producing good quality baby chicks. One of the most modern systems yet developed is shown in Figs. 13–16*a*, *b*, *c*, *d*.

FIG 13–15 Interior of 78,000-egg incubator. The operator works inside the incubator, transferring the chicks from trays into boxes. (Courtesy Western Hatcheries, Dallas, Texas.)

Some system should be used for classifying the chicks by breed and grade as they are removed from the incubator. A system which some use, and which appears effective, is to require the person removing the chicks from the incubator to write the breed of chicks on the lid of the box. Some prefer to write on the box itself, since there is less chance for error, as lids may be transferred from one box to another, thus leading to a mix-up. Numbers written on the box indicate the

There are two general methods of taking off hatches. Some hatcheries follow the practice of allowing the hatch to be completely out before removing it from the incubator; they then count the chicks directly from the trays into the boxes. The chicks are shipped to customers without further counting or grading. This method allows some errors in selection, as it is sometimes difficult to get chicks to stand up

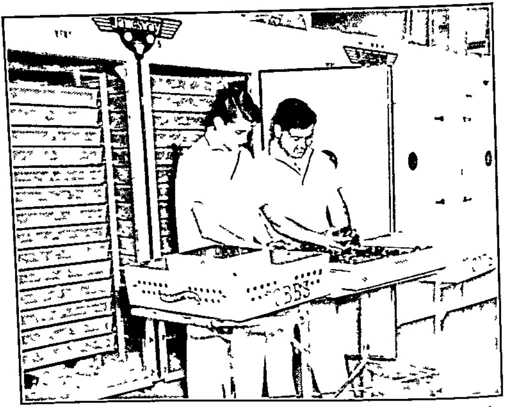
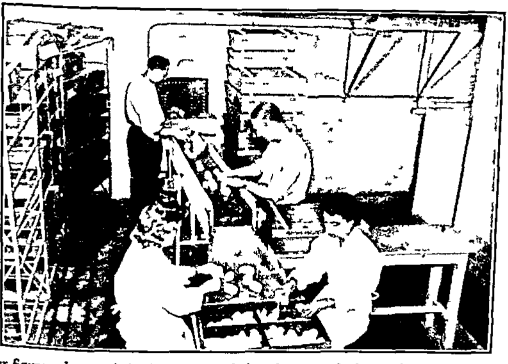


Fig 13–14 Removing chicks from hatcher (Courtesy Cobb's Pedigreed Chicks, Concord, Massachusetts.)

for grading while they are still resting from their struggle of breaking out of the egg shell. A better method seems to be to take the chicks out of the incubator as quickly as possible when they are completely dried off, with no attempt being made to count them. The chicks are allowed to rest in boxes for 4 to 6 hours and are then taken to the counting and grading table where they are sorted into boxes for shipping to customers

Dependent on the type of incubator used, chicks may be taken from separate hatchers and transferred to boxes in a warm room, as in Fig. 13–14, or the person removing the chicks may work inside the ma-



four figures above (*a*) The conveyor belt is being pushed into the hatcher (*b*)
(*c*) Chicks are being counted into the boxes before sexing or culling (*d*) Final
courtesy Dryden Poultry Breeding Farm, Modesto, California)

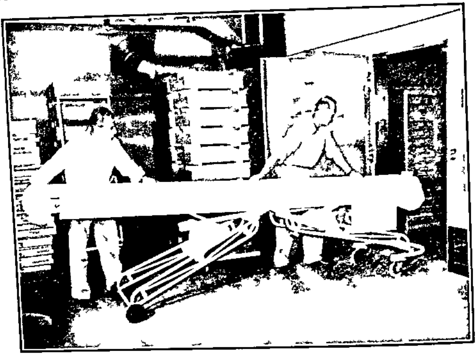


Fig 13-16 The use of conveyors in the hatching operation are shown in the
Chicks are being taken from the hatcher trays and placed on the conveyor belt.
step in the selection of chicks for shipment to customers (Photos

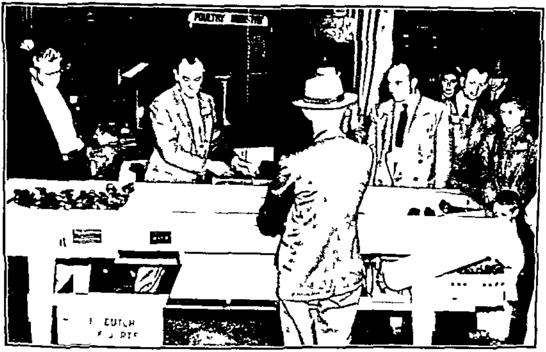


Fig 13-17 Demonstration of new commercial chick sorter at 1950 NEPPCO show (Courtesy Automatic Poultry Feeder Co, Zeeland, Michigan)

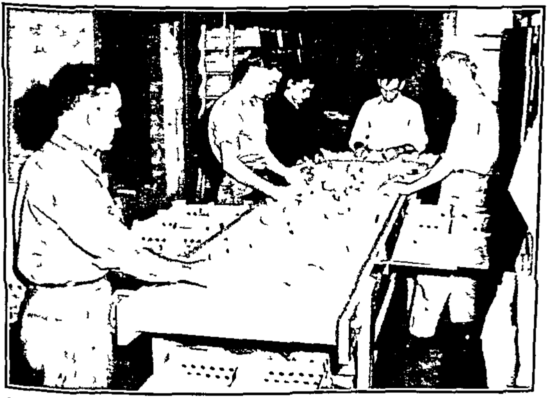


Fig 13-18 Commercial chick sorter in actual hatchery operation Chicks are graded and counted off the conveyor belt which moves continually (Courtesy Corn Belt Hatcheries Joliet, Illinois)

grade of chicks For example, No 1 would indicate best grade, No 2 indicates second best, etc Those producing broiler chicks or key flock chicks for flock replacement may also want to put the flock owner's name on the box, to keep a record of the flock from which each order is filled This also makes it easier to trace any troubles, should they occur If the hatch is completely out when removed from the incubator, the tray card on the tray from which the chicks are taken can be removed and put in between the compartment dividers in the chick box to serve as a record of the source of the chicks

Sorting and Counting Chicks

Sorting grading and counting chicks is a very important job in the hatchery Frequently the importance of this job is overlooked, and it is detailed to someone who does not realize the importance of seeing that customers receive only topgrade, first class, vigorous chicks

Chicks going to broiler growers or for large commercial flocks must be better than just average" These chicks are going to people who are experts in recognizing good quality chicks Most of them make their entire living with chickens It is their business to know good chicks when they see them, as the quality of the chicks received may have a real influence on their future profits The hatchery must do the kind of grading and counting job that will put only the best, most vigorous chicks at the customer s brooder house door

In the counting and grading all undesirable chicks such as cripples, cross beak, blind or otherwise poor chicks should be culled out Look particularly at the navels to see that they are healed and clean appearing Chicks with unhealed navels must be culled out, and particularly should not go on broiler orders since such chicks cannot survive the rigorous conditions and interflock competition present in large-scale commercial flocks Some hatcheries with battery brooders put these chicks with unhealed navels in the brooder, if they are otherwise al right, and sell them out on small local orders where they seem to give satisfaction

Chick grading and counting like many present day tasks, lends itself to mechanization as demonstrated by the commercial chick sorter shown in Fig 13–17 Another view of this same type of sorter in actual hatchery operation is shown in Fig 13–18 The chicks are placed on the conveyor belt, where they ride by the graders who remove the cull chicks and count the good chicks into boxes Those who use this system report that it is very satisfactory, for the chicks seem to stand

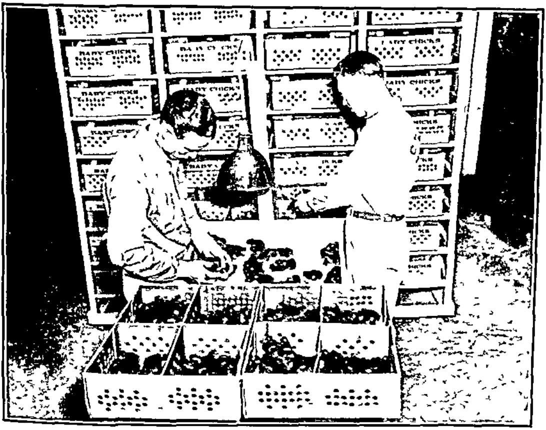


FIG. 13–20. Grading table where chicks are examined under bright light, sorted, and counted into boxes ready for shipment. (Courtesy Colonial Poultry Farms, Pleasant Hill, Missouri.)

Hatchery "Clean-Up"

Sanitation is a "must" in every hatchery. No hatchery can be truly successful for long, if it does not follow reasonably good sanitation practices. Customers do not like to trade in a poorly kept hatchery, and disease may break out at any time if preventive measures are not taken. One hatchery admonishes its help as follows: "if you can't find anything else to do, 'grab a broom.'"

After each hatch, the incubator trays should be removed, the unhatched eggs and egg shells dumped in metal cans or other containers and removed from the hatchery as quickly as possible. Then the hatching compartment should have all movable parts removed and should be thoroughly cleaned of down and shell material. A vacuum cleaner is helpful in doing a good job of cleaning. If chicks hatch in the same machine in which eggs are set, the down should be blown from the eggs in the setting columns, and care should be taken to do the job as quickly as possible and not to allow the temperature in the upper parts

Fig 13–19 Grading chicks for shipment to customers Note that the chicks are up where they are easily seen for accurate grading (Courtesy Corn Belt Hatcheries, Joliet, Illinois)

up better and are more easily graded accurately than by conventional methods

Less spectacular but very effective are the grading tables such as shown in Figs. 13–19 and 13–20. The table in Fig. 13–19 gets the chicks up where they can be easily seen, and the poor quality cull chicks are easily detected and removed. The counting table in Fig. 13–20 is lower, where the chicks are examined under a bright light. The men can work at this table for some length of time without undue fatigue.

It is never good practice in counting chicks to put more than one breed in a box, even if the chicks are easily identified by being of different colors. Someone may sell this mixed box of chicks without checking carefully enough, and the result is a dissatisfied customer. Chicks when counted should be stacked by breed and grade ready for the shipping table. If the shipping floor is marked off by breeds, it will speed up and make for greater accuracy in handling the chicks through the hatchery.

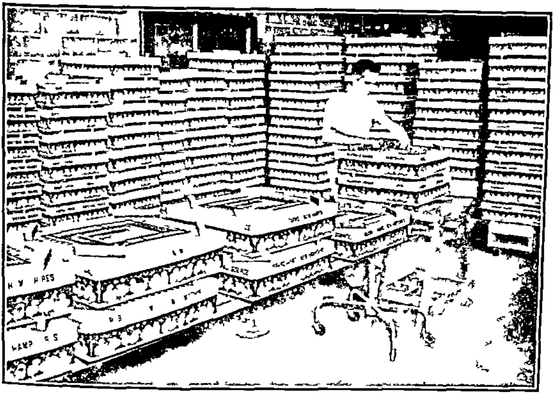


Fig 13-21 Receiving labeled chick boxes on a conveyor belt and wire tieing for shipment to customers (Courtesy Hubbard Farms Walpole N H)

Fig 13-22 A day s hatch of baby chicks ready for shipment to customers in all sections of the United States (Courtesy Booth Farms and Hatchery Clinton Missouri)

of the incubator to get too high when the fans are turned off for cleaning

Trays should be put in tray carts and wheeled to the back of the hatchery where the egg shells are dumped Empty dump cans should never be taken into the incubator as it is difficult to clean them thoroughly and they might carry contaminating material which could introduce disease into the machines

Hatchery "clean up" should include keeping the floor swept including the space back of the incubators and "out of sight" places Also down should be kept off the tops of the incubators Down or dirt allowed to accumulate any place in the hatchery may be a source of contamination leading to navel infection or omphalitis The back of the hatchery should be kept as clean as the front Cans for holding egg offal from the incubators should be washed clean and disinfected each time they have been emptied All measures of cleanliness should be taken to reduce the incidence of flies during the summer months

Shipping Baby Chicks

Orders for shipping chicks are made up in the office and if chicks are to be shipped on several trains the orders are grouped so that chicks going out on the early trains will be shipped first

Usually it is necessary to send only the labels to the hatchery for shipping If a record of the flock from which the order is filled is kept this may be written on the order ticket by the person making up the order

Shipping labels should be sorted by breeds to speed up the shipping process Shippers work from the stacks of chick boxes that have been graded and counted The shipper should lift the lid on each box and check the chicks before passing the labeled box on to the person who is tieing up the boxes Any apparent errors in the quality of the chicks shipped or serious error in counting can be detected by this last minute check up

If chicks are being shipped by parcel post two 100 size boxes should be tied together if the order is for several hundred chicks Most hatcheries use a tieing wire and rent the small tieing machines which are used to tie the wire tightly around the boxes Some hatcheries trucking chicks to their customers or shipping single boxes use a staple to fasten the lid to the box The lid of the box has 4 square holes in it to permit application of the hand stapler Tieing of boxes together for shipment to customers is shown in Fig 13–21 The "special handling" fee charged for handling each bundle of chicks is reduced when

14

Hatchery Correspondence and Office Procedure

Customers and their orders for baby chicks are the life of the hatchery business If orders are not handled correctly, if proper acknowledgments are not given, chicks not shipped or delivered on time, and correct billing made, the customer may not be completely satisfied, regardless of the good quality of the chicks received

Hatcheries that have a large volume of mail orders, with relatively little local business, or broiler chick business, must be especially alert to follow efficient office procedure The letters, circulars, catalogs, and other mail sent out from the mail order hatchery are its prime selling tools To be less than efficient in this important phase of the hatchery operation is to lose business

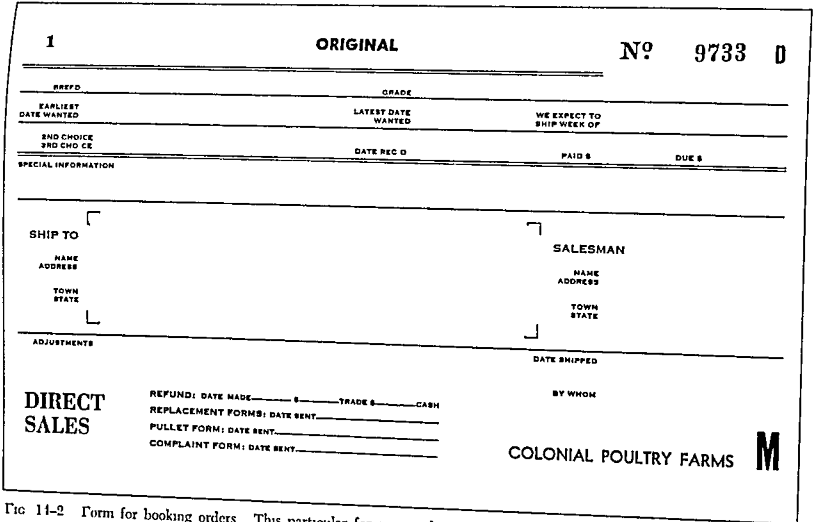
Those who are starting in the hatchery business for the first time should study the office methods of successful hatcheries and develop a system which is efficient and embodies the methods of others that have been tried and proved through the years This point cannot be too strongly emphasized Actually, many hatcheries operating today are loose in their handling of records and accounts This has been due in part to the continual focus in our training schools on production methods that produce a quality chick The important phase of correct and complete office records is frequently neglected by those engaged in hatchery work With the maturity of the hatchery industry, business methods based on accurate records will become essential to the successful hatchery

The Hatchery Office

The hatchery office should be clean, attractive, and arranged for efficient handling of orders and correspondence The office and its appearance are frequently the first impressions the customer gets of the hatchery on entering the building An attractive, well arranged office is a forward step in the process of selling the customer It is also

two boxes are tied together, as the fee remains the same for 1 box or for 2 boxes if tied together to make a single bundle

Hatcheries shipping by rail find it more difficult to ship to many parts of the country than in the early days principally because there are now fewer trains that will carry chicks The present tendency for fast, through train service for passengers between large city points has reduced the number of trains picking up parcel post or express shipped chicks This has necessitated unusually heavy shipments for some of the very large hatcheries, as illustrated in Fig 13–22 However, despite limitations in shipping facilities, rail service remains remarkably good, and chicks reach their destination frequently in much better condition than formerly, because greater care is now taken in routing chick shipments



1 ORIGINAL Nº 9733 D

BREED GRADE

EARLIEST DATE WANTED LATEST DATE WANTED WE EXPECT TO SHIP WEEK OF

2ND CHOICE 3RD CHOICE DATE REC'D PAID $ DUE $

SPECIAL INFORMATION

SHIP TO
NAME
ADDRESS
TOWN
STATE

SALESMAN
NAME
ADDRESS
TOWN
STATE

ADJUSTMENTS

DATE SHIPPED

BY WHOM

DIRECT SALES

REFUND: DATE MADE________ $________TRADE $________CASH
REPLACEMENT FORMS: DATE SENT________
PULLET FORM: DATE SENT________
COMPLAINT FORM: DATE SENT________

COLONIAL POULTRY FARMS M

FIG 11-2 Form for booking orders This particular form is made in 5 parts, with 1 of the 5 parts being used for the order acknowledgment (Courtesy Colonial Poultry Farms, Pleasant Hill, Missouri)

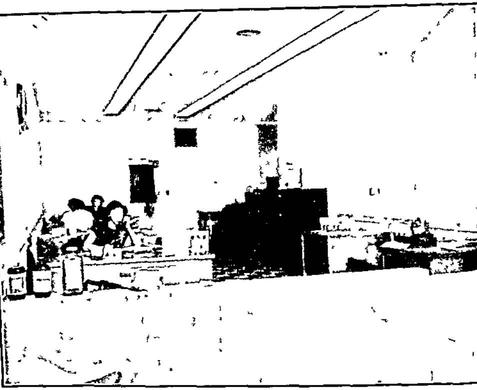


FIG. 14-1. This air-conditioned modern office room is attractive to customers, and comfortable and clean for office personnel (Courtesy Calhoun Poultry Farm and Hatchery, Montrose, Missouri)

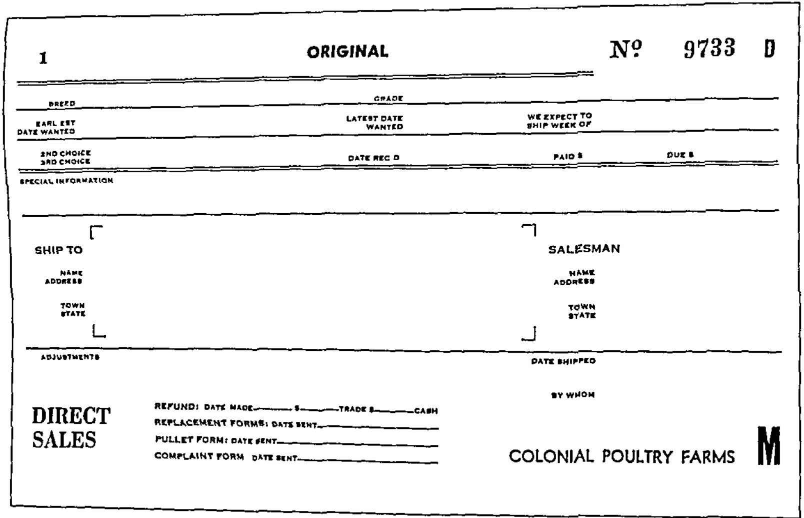
helpful in getting desirable personnel for office work. Office personnel dislike working in an atmosphere of chick down, dust, and egg odors The office of a modern hatchery is shown in Fig 14-1.

PROCESSING THE CHICK ORDER

In the receiving and processing of chick orders received by mail, several steps are necessary that are not needed when one is engaged in a strictly local business where the customer calls at the hatchery for the chicks. In dealing with customers by mail, it is essential that they be notified of the time they are to receive their chicks, that their order be properly acknowledged, and that sufficient records are on hand concerning the order to enable checking back easily in the event of additional correspondence regarding it.

The actual processing of the chick order may involve some of the following steps:

1. The mail is opened, and any deposit on the order, or other money, is promptly noted on the order blank. The cash, check, or money



1 ORIGINAL No. 9733 D

BREED GRADE

EARLIEST DATE WANTED / LATEST DATE WANTED / WE EXPECT TO SHIP WEEK OF

2ND CHOICE / 3RD CHOICE / DATE REC'D / PAID $ / DUE $

SPECIAL INFORMATION

SHIP TO
NAME
ADDRESS
TOWN
STATE

SALESMAN
NAME
ADDRESS
TOWN
STATE

ADJUSTMENTS

DATE SHIPPED

BY WHOM

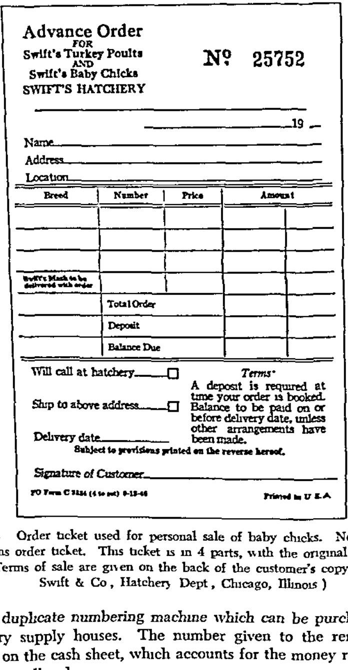
DIRECT SALES

REFUND: DATE MADE______ $______ TRADE $______ CASH
REPLACEMENT FORMS: DATE SENT______
PULLET FORM: DATE SENT______
COMPLAINT FORM DATE SENT______

COLONIAL POULTRY FARMS M

Fig. 11-2 Form for booking orders This particular form is made in 5 parts, with 1 of the 5 parts being used for the order acknowledgment (Courtesy Colonial Poultry Farms, Pleasant Hill, Missouri)

orders are grouped together for listing on the daily cash sheet. One hatchery circles the amount received with pencil. The order blank received and the remittance are then stamped with the same numbers,



Advance Order
FOR
Swift's Turkey Poults
AND
Swift's Baby Chicks
SWIFT'S HATCHERY

№ 25752

__________ 19 __

Name __________
Address __________
Location __________

Breed	Number	Price	Amount	
Swift's Mash to be delivered with order				
	Total Order			
	Deposit			
	Balance Due			

Will call at hatchery ____ ☐

Ship to above address ____ ☐

Delivery date ________

Terms:
A deposit is required at time your order is booked. Balance to be paid on or before delivery date, unless other arrangements have been made.

Subject to provisions printed on the reverse hereof.

Signature of Customer __________

PO Form C [illegible] (4 to set) [illegible]

Printed in U S A

FIG 14-3 Order ticket used for personal sale of baby chicks. Note that customer signs order ticket. This ticket is in 4 parts, with the original for the customer Terms of sale are given on the back of the customer's copy. (Courtesy Swift & Co, Hatchery Dept, Chicago, Illinois)

using a duplicate numbering machine which can be purchased from stationery supply houses. The number given to the remittance is entered on the cash sheet, which accounts for the money received for the day on all orders.

GENERAL OFFICE COPY

Western

RESEARCH DEVELOPMENT HATCHING
A COMPLETE POULTRY BREEDING PROGRAM

COOPERATIVE HATCHERIES

FORMERLY WASHINGTON COOPERATIVE CHICK ASSOCIATION AT BELLINGHAM

ORDER

GENERAL OFFICE BOX 628 BELLEVUE WASH

44- 1

NAME ____________ DATE OF ORDER ______

ADDRESS ____________ SALES CODE ______

CITY & STATE ____________ APPROX DELIVERY WEEK OF ______

SHIP TO ____________

THIS ORDER SUBJECT TO ACCEPTANCE BY GENERAL OFFICE
AND TO THE TERMS ON REVERSE SIDE OF THIS SHEET

QUANTITY	DESCRIPTION	SEX	PRICE	AMOUNT

INSTRUCTIONS

TOTAL	
QUANTITY DISCOUNT	
FRYER DISCOUNT	
SALES TAXABLE TOTAL	
SALES TAX	
MEMBERSHIP FEE	
TOTAL	
DEPOSIT PAID WITH ORDER	
CASH DUE ON DELIVERY	
CREDIT DUE YOU	

MEMBER'S SIGNATURE ____________

COOPERATIVE REPRESENTATIVE ____________

FORM NO 1

Fig 14–4 Three part order ticket used by salesmen Note the space for special instructions, also that orders are taken subject to acceptance by the general office This is essential when several salesmen are selling chicks from the same hatch. (Courtesy Western Cooperative Hatcheries, Bellevue Washington)

(*c*) #3 copy is filed in the hatchery. Filing is done geographically by states and alphabetically by first letter of last name.

(*d*) #4 copy is copy for the mailing room, for entering customer's name in the current order file, and for plating.

(*e*) #5 copy is copy for the hatchery's numerical file Copies are filed in a book numerically, in consecutive order, by order numbers shown in the upper right hand corner of the order ticket.

Cullman, Alabama

Dear Customer.

We plan to ship your order No ....

on ....

Should you write us concerning this order before it is shipped, be sure to return this card If you write us after receiving the chicks, you need not return this card, but be sure to mention breed and number ordered and delivery date booked for

Thanking you for your order, we are

Cordially yours,

COLONIAL POULTRY FARMS

FIG. 14-6 Notification card which is mailed to chick customer 3 to 5 days in advance of shipment of chicks

4. The order is booked, after checking the chick report or setting report to see that the chicks will be available.

5. The original order copy is placed in the order file. This order file is divided by hatching dates and breeds. Before shipping, the order ticket must have a label or labels made for it, for shipping to the customer. One label must be made for each box. Chick boxes are in units of 25, 50, and 100 chick size. The 100-size box is the most common unit used.

6. From 3 to 5 days in advance of shipment, a notification card is sent to the customer, telling him of the exact shipping date. This serves as a reminder to the customer to get the brooder house and stove ready and in other ways to prepare for the arrival of the chicks. Figures 14-6, 14-7, and 14-8 illustrate notification cards.

2. Any correspondence relative to orders already booked or shipped is sent to the correct department for reply. This may involve checking with the original order ticket to get the necessary information for answering the letter.

ORDER ACKNOWLEDGMENT

ORDER NO ____________ DATE ____________

NAME ____________

STREET OR R F D ____________

CITY ____________ STATE ____________

HOW TO SHIP ____________ DATE WANTED ____________

NUMBER	DESCRIPTION	PRICE	AMOUNT
		$	$
		TOTAL	$
		AMOUNT PAID	$
		BALANCE DUE	$

FIG 14–5 Type of order ticket adaptable to many hatcheries, as it gives all essential information for most hatcheries This ticket is in 2 parts, with the second copy headed "Shipping Order." (Courtesy American Poultry and Hatchery Federation, Kansas City, Missouri)

3. After the money received with the order is properly credited and accounted for, the order goes to the booking department Different hatcheries use different systems of booking orders Some use very complex order tickets, and others do not use any order tickets at all (See Figs 14–2, 14–3, 14–4, and 14–5.) One large mail order hatchery uses a 5-part order ticket (Fig 14–2), with the following disposition of the 5 different copies.

(*a*) Original #1 copy is for the hatchery's order file

(*b*) #2 copy is the acknowledgment that goes to the customer. This copy has all guarantees given on the back of the ticket.

(c) #3 copy is filed in the hatchery. Filing is done geographically by states and alphabetically by first letter of last name.

(d) #4 copy is copy for the mailing room, for entering customer's name in the current order file, and for plating.

(e) #5 copy is copy for the hatchery's numerical file. Copies are filed in a book numerically, in consecutive order, by order numbers shown in the upper right hand corner of the order ticket.

Cullman, Alabama

Dear Customer.

We plan to ship your order No ....

on ....

Should you write us concerning this order before it is shipped, be sure to return this card. If you write us after receiving the chicks, you need not return this card, but be sure to mention breed and number ordered and delivery date booked for.

Thanking you for your order, we are

Cordially yours,
COLONIAL POULTRY FARMS

FIG. 14-6. Notification card which is mailed to chick customer 3 to 5 days in *advance of shipment of chicks*

4. The order is booked, after checking the chick report or setting report to see that the chicks will be available.

5. The original order copy is placed in the order file. This order file is divided by hatching dates and breeds. Before shipping, the order ticket must have a label or labels made for it, for shipping to the customer. One label must be made for each box. Chick boxes are in units of 25, 50, and 100 chick size. The 100-size box is the most common unit used.

6. From 3 to 5 days in advance of shipment, a notification card is sent to the customer, telling him of the exact shipping date. This serves as a reminder to the customer to get the brooder house and stove ready and in other ways to prepare for the arrival of the chicks. Figures 14-6, 14-7, and 14-8 illustrate notification cards.

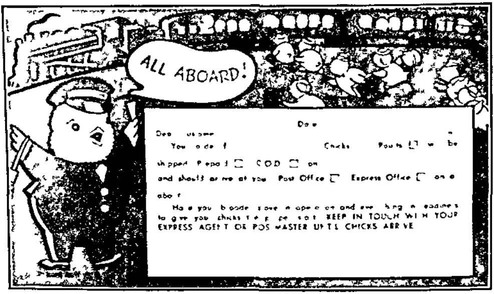


Fig 14–7 This attractive card notifies the customer as well as urges preparation for the arrival of the chicks (Courtesy American Poultry and Hatchery Federation, Kansas City, Missouri)

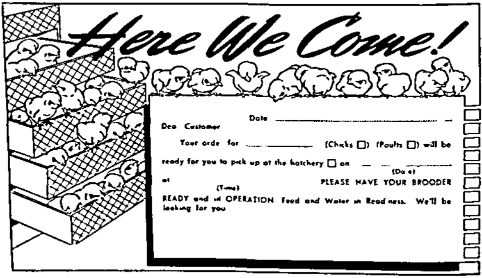


Fig. 14–8 This card is for mailing to local customers to notify them of the date they are to call at the hatchery for their chicks (Courtesy American Poultry and Hatchery Federation, Kansas City, Missouri)

7 If the customer has made a deposit on the order and there is a balance due, the customer is notified 10 to 15 days in advance of shipment of the amount due on the order If this is not received in advance of shipping date, and the customer has indicated his desire for C O D shipment, the order is sent C O D for the balance due, and usually the shipping charges are added to this balance

8 Immediately following shipment, accounts shipped open to hatcheries or wholesale dealers should be billed It is important to be accurate and prompt in billing, and then use a check up system to see that payment comes in after the billing

Rules for Handling Mail

When a large volume of mail is being received, it must be handled quickly and efficiently to keep it up to date and prevent its accumulating without reply This may not seem important to the casual observer, but in the height of a busy season mail can accumulate in great quantity if some system is not worked out to handle it The tendency of most people who work with a quantity of mail for the first time is to sort over the mail, reply to the letters that are easy to answer, and put the more difficult problems aside to be dealt with later This system, or lack of system, can prove fatal in the successful handling of mail

The following instructions are issued to new office personnel by one organization

> All mail must be answered in 24 hours For example, Monday's mail must be answered by Tuesday
>
> In case mail is not answered by the end of a 24 hour period, the office should get it up at night For example, when Tuesday evening comes, and mail for Monday is still not done, some person, or persons, should finish it Tuesday night and the manager should take steps to remedy the situation at once, so this overtime won t be needed again
>
> Put each day s mail in a box and date it Get each day's mail completely handled before the next day's is taken up If you get the bulk of your mail in the morning, you should let that be your dividing line between days For example, the mail you get on Monday morning should go in Monday's mail, while the mail that is received later in the day will go in Tuesday's box, and when Tuesday's morning mail is put in the box, it completes it for Tuesday, etc
>
> When all the day s mail is done and there is still time you should start in on the next day s mail For example, if by 2 P M you have Monday's mail all done you can start taking mail out of the Tuesday box But each day s box of mail must be completely done before going to the next day's Each and every piece of mail must be finished This includes orders, inquiries, complaints, and correspondence of all kinds

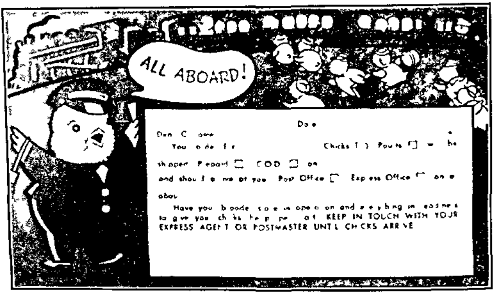


Fig 14–7 This attractive card notifies the customer as well as urges preparation for the arrival of the chicks (Courtesy American Poultry and Hatchery Federation Kansas City, Missouri)

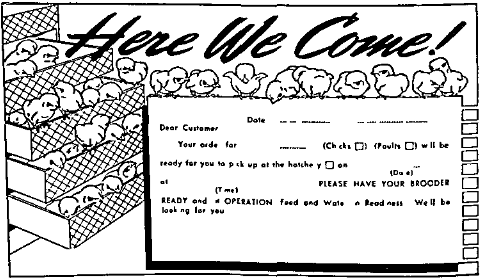


Fig 14–8 This card is for mailing to local customers to notify them of the date they are to call at the hatchery for their chicks (Courtesy American Poultry and Hatchery Federation, Kansas City, Missouri)

number gıven to the remıttance with the duplıcate numberıng machıne prevıously mentıoned Then the customer s name ıs entered, the ad dress of the customer, and the correct symbol gıven to ındıcate whether

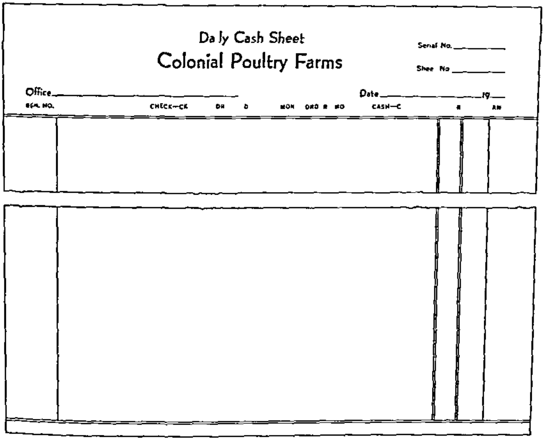

Da ly Cash Sheet
Colonial Poultry Farms
Serial No.______
Shee No ______
Office______ Date______19__
SER. NO. CHECK—CK DR D MON ORD R MO CASH—C R AN

Fig 14–10 Daily cash sheet on which all remittances received daily are entered *The totals of the daily cash sheet must equal the total of the daily bank deposit*

the remıttance ıs by check, draft, money order or cash It ıs usually more convenıent to group each type of payment together for entry on the cash sheet

Check and Deposıt Regıster

All checks paıd out for purchases by the hatchery and all ıncome and deposıts of the hatchery are ıtemızed on the check and deposıt regıster (shown ın Fıg 14–11) Sınce the deposıts have already been ıtemızed on the daıly cash sheet the total of the deposıt made daıly can be entered and credıted properly to eıther local or natıonal sales The balance of cash on hand ın the bank ıs shown at a glance by totalıng the deposıts and addıng to the old balance less the checks drawn agaınst the account It ıs good busıness for the hatcheryman to have a record and know what the cash balance on hand ıs at all tımes A

HATCHERY RECORDS

Complete accurate records of all phases of the hatchery operation are essential To operate successfully, the hatchery must know how many eggs are set in each breed, how many chicks are estimated to hatch and must match the anticipated hatch with orders on hand for a definite delivery date or in prospect Records of cash or check payment for eggs are necessary, payments to personnel for labor, inventories of supplies—all these require accurate records Some hatcheries have their own record forms (Fig 14-9) However, many use the

Hatchery Patron Record

Name	Address	Equipment

Date	Head	Variety	Price	Origin of Eggs	% Mortality at 3 Weeks	[illegible]	Down Payment	Date Service Calls	Remarks

PO Form C 63 … *Remarks on Service Calls on Reverse Side Printed in U.S.

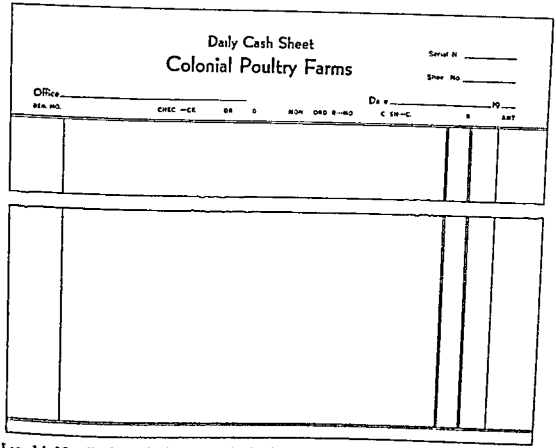
Fig 14-9 Hatchery Patron Record gives a complete history of each customer s purchases Such records are valuable in building up a local business (Courtesy Swift & Co Hatchery Division Chicago Illinois)

record forms prepared for hatcheries by the American Poultry and Hatchery Federation These forms are available to members of the American Poultry and Hatchery Federation at a nominal cost.

Daily Cash Sheet

Hatcheries with 100 000 or larger capacity with several persons working in the office, may want to use a daily cash sheet. On this daily cash sheet is entered all the income for the day All checks, cash and money orders received in the mail and from local customers are entered on the daily cash sheet. (See Fig 14-10) The remittance number is entered first of all, in the left hand column This is the

number given to the remittance with the duplicate numbering machine previously mentioned Then the customer s name is entered, the ad dress of the customer, and the correct symbol given to indicate whether


Daily Cash Sheet
Colonial Poultry Farms
Serial N ____
Sheet No ____
Office ____
Date ____ 19__

REM. NO.	CHEC —CK DR D MON ORD R—MO C SH—C.	$	AMT

Fig 14–10 Daily cash sheet on which all remittances received daily are entered The totals of the daily cash sheet must equal the total of the daily bank deposit

the remittance is by check draft, money order or cash It is usually more convenient to group each type of payment together for entry on the cash sheet

Check and Deposit Register

All checks paid out for purchases by the hatchery and all income and deposits of the hatchery are itemized on the check and deposit register (shown in Fig 14–11) Since the deposits have already been itemized on the daily cash sheet the total of the deposit made daily can be entered and credited properly to either local or national sales. The balance of cash on hand in the bank is shown at a glance by totaling the deposits and adding to the old balance less the checks drawn against the account It is good business for the hatcheryman to have a record and know what the cash balance on hand is at all times A

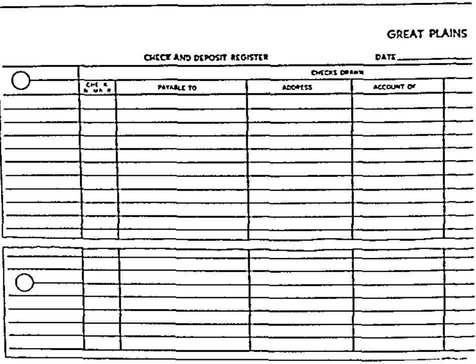

GREAT PLAINS
CHECK AND DEPOSIT REGISTER
DATE
CHECKS DRAWN
CHECK NUMBER
PAYABLE TO
ADDRESS
ACCOUNT OF

FIG 14–11 The check and deposit register is a record of all income and expense Effingham

separate payroll sheet may be kept, which itemizes the time of each worker, the hourly rate of pay, and deductions for social security, withholding tax, and other necessary payroll deductions The total paid out on the payroll sheet may be entered as a single paid out item on the check and deposit register sheet to reflect the true bank balance at all times

Inventory

A current inventory of resale items such as feed, equipment, and supplies is helpful in determining the need for additional items for resale, and to determine currently whether or not the sale of such supplies is profitable Many times it may appear that such items are profitable to handle, but, when all costs of handling labor, space, advertising and other items of overhead are considered the sale of certain supplies may actually be at a loss or break even basis One type of inventory that has proved satisfactory is shown in Fig 14–12

A complete inventory of all physical property of the hatchery is usually made annually for the annual hatchery audit or financial report Such an inventory would include all property such as desks typewrit

HATCHERIES

________ 19__

			DEPOSITS					
TAX DED	FOLIO	AMOUNT	FOLIO	AMOUNT	ACCOUNT OF	OLD BALANCE	DEPOSITS	NEW BALANCE

It is made daily in the peak hatching season (Courtesy Great Plains Hatcheries Illinois)

ers, stationery supplies, labels, and furniture in the office In the hatchery it would include all incubators, fans, supplies, equipment, boxes, pads, stitching or tieing wire, formaldehyde—in fact, all property and supplies used in the hatchery

Egg Buying Record

Egg purchases are the greatest single expense in hatchery operation A system of accounting for all eggs purchased should be developed that will allow an accurate check of eggs at all times

Eggs may be paid for by cash or check A few hatcheries have used the payment of cash to highlight the value of the hatchery industry to a community, by selecting a certain day during the spring when the bulk of eggs are received, and paying for all egg deliveries on that day with silver dollars The silver dollars make their way into the business houses of the town and give prestige to the hatchery as a valuable asset of the community

Some hatcheries pay market price in advance for hatching eggs, and then pay the flock owner for all good hatching eggs deducting for eggs that do not meet the requirements of the hatchery Checks used with

COLONIAL POULTRY FARMS
Inventory Record

SUPPLIES Date ________

PLANT ________

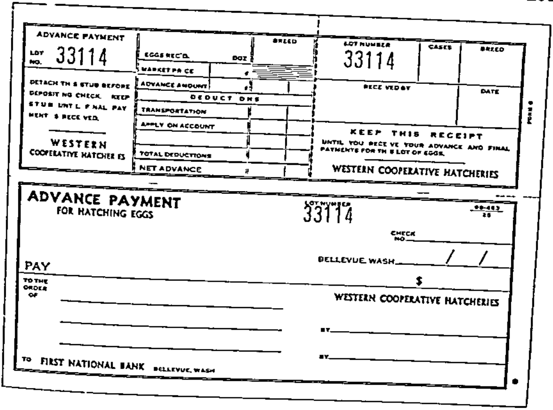
ITEM	UNIT	BRAND	On Hand Last Invent.	Rec d New	TOTAL	Sales for Period	Present Book Invent.	Over or Short	Actual Invent.	Cost Per Unit	TOTAL COST
Brooders											
Brooders											
Feeders											
Feeders											
Feeders											
Feeders											
Founts											
Founts											
Founts											
Founts											
Founts											
Founts											
Fount Base											
Heaters											
Egg Scales											
Therm											
Therm											
Wafers											

Fig 14–12 Inventory record of items for resale This type of record can also be used successfully for feed inventory Inventory may be taken weekly or monthly depending on sales volume

this system are shown in Fig 14–13 Paying on the basis of hatchability may also be followed with this system of payment

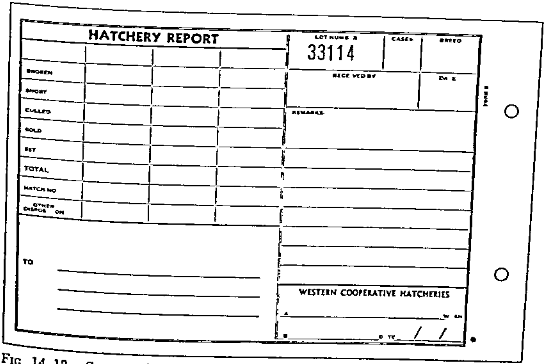
If a large volume of eggs are bought, it may be advisable to set up a separate egg account at the bank, writing checks on this egg account, and then reimbursing the egg account from the general account at the end of the buying day or less often

A daily egg report such as shown in Fig 14–14 gives an accurate picture at all times of the number of eggs bought daily and to date



ADVANCE PAYMENT
LOT NO. 33114
DETACH THIS STUB BEFORE DEPOSITING CHECK. KEEP STUB UNTIL FINAL PAYMENT IS RECEIVED.
WESTERN COOPERATIVE HATCHERIES
EGGS REC'D. DOZ
MARKET PRICE
ADVANCE AMOUNT
DEDUCTIONS
TRANSPORTATION
APPLY ON ACCOUNT
TOTAL DEDUCTIONS
NET ADVANCE
BREED
LOT NUMBER 33114
CASES
BREED
RECEIVED BY
DATE
KEEP THIS RECEIPT
UNTIL YOU RECEIVE YOUR ADVANCE AND FINAL PAYMENTS FOR THIS LOT OF EGGS.
WESTERN COOPERATIVE HATCHERIES

ADVANCE PAYMENT
FOR HATCHING EGGS
LOT NUMBER 33114
CHECK NO.
BELLEVUE, WASH. / /
PAY
TO THE ORDER OF
$
WESTERN COOPERATIVE HATCHERIES
BY
BY
TO FIRST NATIONAL BANK BELLEVUE, WASH



HATCHERY REPORT
BROKEN
SHORT
CULLED
SOLD
SET
TOTAL
HATCH NO
OTHER DISPOSITION
TO
LOT NUMBER 33114
CASES
BREED
RECEIVED BY
DATE
REMARKS
WESTERN COOPERATIVE HATCHERIES
WASH.
DATE / /

FIG 14–13 System of payment for eggs where payments are made on basis of good hatching eggs delivered and hatchability This form is in 4 parts with carbon paper between each part (Courtesy Western Cooperative Hatcheries, Bellevue, Washington)

HE ______ per doz	EGG REPORT	CX ______ per doz.
ME ______ per doz.	______ Plant	Exp Amt. $ ______

No ______ Date ______

EGGS BOUGHT	Brot. Fwd	Today	Total To Date
Amount Paid	$ ______	$ ______	$ ______
Number of dozens	______	______	______
Eggs on floor preced ng report		______	
TOTAL eggs on floor day		(A) ______	
Today s base egg price		______ ¢	

Checks for express on eggs or return of cases should be written on an egg check and must be included in Amount Paid above

Eggs check included this report, # to # , inclusive

EGG BALANCE (figures in dozens)			
Hatching eggs sold	______	______	______
Eggs Trayed	______	______	______
Sold on Market	______	______	______
Cracks sold	______	______	______
Eggs Broken Not Salable	______	______	______
TOTAL	______	______	______
Eggs on Floor End of Day (must be actual count)		______	
GRAND TOTAL		(B) ______	

When egg report is n balance Total Eggs Disposed of To Date will equal Total Eggs Bought To Date and there will be no unaccounted-for eggs

Eggs Set (Not Dozen)	______	______	______
Chicks Hatched	______	______	______
Percentage of Hatch Today	______		

Fig 14–14 Egg report for daily accounting for eggs purchased, set and disposed of (Courtesy Colonial Poultry Farms)

From this information the average cost of eggs bought for any particular period may be figured This information may be essential in the pricing of chicks, as eggs are the biggest single item of expense of production An actual floor count of eggs on hand should be made once or twice per week, and this should be checked against purchases and egg sets Eggs may be easily converted into cash by unscrupulous persons, and it is advisable to keep an accurate check on them at all times

Setting Record

A record of each setting of eggs is made at the time the eggs are set in the incubators This record may be compiled from figuring the egg purchase tickets if eggs are being purchased only once or twice per week Hatcheries purchasing eggs daily rely on an actual count of the trays being set and the actual count of eggs in each tray as shown by the count entered by the egg trayer on the tray card The setting report shown in Fig 14–15 shows the set by breeds as well as grades

A form that may supplement the setting report, for use in the office in booking orders, is the "sure date" card This card gives the actual number of chicks of each breed and grade for each hatch As the chicks are booked for orders each day, the number of chicks sold is deducted from the total, so that an accurate record is available in the office at all times of the actual number of chicks available and unsold from any particular hatch This form is the card shown in Fig 14–16

Record of Chicks Hatching and Sold

A record of the number of chicks sold and the number hatching for each week is given in the weekly chick report, as shown in Fig 14–17 In preparing any report involving the accounting for sexed chicks, it must be kept in mind that it requires approximately double the number of straight run chicks to produce a given number of pullets, also, that Leghorn cockerels have very little value in relation to the total number of chicks sold Orders for Leghorn cockerels must always be taken on the basis of pullets already sold Unless this is given careful consideration, the hatchery may be forced into sexing a large number of chicks to produce Leghorn cockerels for sale, which have little or no value, and forcing the sale of pullets at below cost of production prices

In figuring a chick report of the type shown in Fig 14–17, to get the total number of chicks sold in Leghorns and Leghorn crosses, one should double the number of pullet chicks sold and disregard the cock-

COLONIAL POULTRY FA

PLANT ____________ EGGS SET CHIX HATCHED

SETTING REPORT NO. ____________ FORWARDED ____________ FORWARDED ____________

DATE SET ____________ 19____ TODAY ____________ TODAY ____________

DATE TO HATCH ____________ 19____ TO DATE ____________ TO DATE ____________

Incubator	WHITE LEGHORNS				BARRED ROCKS				WHITE ROCKS		
	Low	Mid.	High	R. O. P. S.	Low	Mid.	High	R. O. P. S.	Low	Mid.	High
Total Eggs											
Estimated No. Chicks											
at % Chicks Hatched											
Per Cent of Hatch											

Incubator	HAMP X WHITES			ALSTRA X WHITES			MINORCA X LEGHORNS			Austra-Hamps	Black Aust
	Low	Mid.	High	Low	Mid.	High	Low	Mid.	High		
Total Eggs											
Estimated No. Chicks											
at % Chicks Hatched											
Per Cent of Hatch											

FIG 14–15 Setting record shows the number of eggs set on a particular date, 65% to 75% depending on the season. This gives an estimate

RMS SETTING REPORT

	CUSTOM HATCH	CUSTOM HATCH
AVERAGE OF HATCH ________ %	EGGS SET ________	CHICKS HATCHED ________
LOCAL EGG MARKET ________ ¢	FORWARD ________	FORWARD ________
AVERAGE OF CUSTOM HATCH ____ %	TOTAL TO DATE ________	TOTAL TO DATE ________

	S. C. REDS				WHITE WYANDOTTES				NEW HAMPSHIRES			
R. O. P. S	Low	Mid.	High	R. O. P. S	Low	Mid.	High	R. O. P. S	Low	Mid.	High	R. O. P. S

Trap-Lines		BROILER CHICKS							Light	Asst.	TOTAL	
			NEW HAMPS	WHITE ROCKS	DEL X HAMPS	WYAN X HAMPS	COR. HEN X HAMPS	CORNISH X ROCKS	Asst.	Heavy		

in each incubator, by breeds and by grades Eggs set are estimated to hatch at of the number of chicks available from a given hatch

WHITE WYANDOTTES				BUFF ORP		WHITE GIANTS		NEW HAMPSHIRES				BRN LEG			
Std	Spl	Best	R O P	Std	Spl	Std	Spl	Std	Spl	Best	R O P	Std.	Spl		
NUMBER CHICKS HATCHING															

W LEG X W ROCKS			AUST X WHITE			M N X LEG			BLK. AUSTRALORPS			Blk. Min	Tu-Line		
Std	Spl	Best	Std	Spl	Best	Std	Spl	Best	Std	Spl	Best				
NUMBER CHICKS HATCHING															

FIG 14–16 "Sure-date" card used in office to keep account of chicks sold from breed available from a hatch in the event of phone calls or other

												Lt. Asst.	Hv Asst.	W L Males	LA Males

NUMBER CHICKS HATCHING

COLONIAL POULTRY FARMS

DAY AND TIME OF HATCH

WHITE LEGHORNS				BARRED ROCKS				WHITE ROCKS				S. C. REDS			
Std	Spl	Best	R O P	Std.	Spl	Best	R O P	Std	Spl	Best	R O P	Std	Spl	Best	R O P

NUMBER CHICKS HATCHING

each hatch This enables one to determine at once the number of chicks of each requests for an immediate answer (Courtesy Colonial Poultry Farms)

CHICK

HATCH ESTIMATED AT_______%

	WHITE LEGHORNS								BARRED ROCKS				
	WEEK	S.R.	MALES	PUL.	TOTAL	HATCH	LONG	SHORT	S.R.	MALES	PUL.	TOTAL	HATCH
1													
2													
3													
4													
5	SUB TOTAL												
6													
7													
8													
9													
10	LATER												
11	TOTAL												

		WHITE WYANDOTTES							NEW HAMPSHIRES				
	WEEK	S.R.	MALES	PUL.	TOTAL	HATCH	LONG	SHORT	S.R.	MALES	PUL.	TOTAL	HATCH
1													
2													
3													
4													
5	SUB TOTAL												
6													
7													
8													
9													
10	LATER												
11	TOTAL												

		MIN X LEG											
	WEEK	S.R.	MALES	PUL.	TOTAL	HATCH	LONG	SHORT	SOLD	HATCH	SOLD	HATCH	Hy. CAN.
1													
2													
3													
4													
5	SUB TOTAL												
6													
7													
8													
9													
10	LATER												
11	TOTAL												

FIG 14–17 This type of report shows the number of chicks hatching for each
Farms, Pleasant

REPORT

DATE __________ PLANT __________

WHITE ROCKS									S. C. REDS						
LONG	SHORT	S. R.	MALES	PUL.	TOTAL	HATCH	LONG	SHORT	S. R.	MALES	PUL.	TOTAL	HATCH	LONG	SHORT

TRUE LINES									AUSTRA WHITES						
LONG	SHORT	S. R.	MALES	PUL.	TOTAL	HATCH	LONG	SHORT	S. R.	MALES	PUL.	TOTAL	HATCH	LONG	SHORT

					TOTAL SOLD	TOTAL HATCHING	DO NOT INCLUDE H REPORT TO AL					
LL. CHK.	SOLD	HATCH	SOLD	HATCH			H. CHK.	LONG	SHORT	LL. CHK.	LONG	SHORT

breed by weeks, and the number of chicks sold (Courtesy Colonial Poultry Hill, Missouri)

erels, adding only the straight run chicks plus double the number of pullets sold to get the total sold If the number sold is more or less than the number hatching, the number long or short is entered accordingly in the proper column In figuring the total of the heavy breeds sold, the number of pullets is doubled only when the number of males sold is less than the number of pullets sold If the number of males is greater than the number of pullets sold, the total is obtained by adding the actual figures of chicks sold for straight run, males, and pullets Heavy breed cockerels have a relatively high sales value and therefore are considered the same as straight run and pullets in calculating the number of chicks sold

HATCHERY CORRESPONDENCE

There are many phases of hatchery correspondence the answering of inquiries, the reply to specific questions regarding an order, dealing with management problems, and response to complaints All this correspondence must be handled so that the person receiving the answer is completely satisfied and continues to be favorably impressed with the quality of chicks being offered by the hatchery To do this requires tact, diplomacy, a knowledge of poultry and poultry problems, and salesmanship

Answering Inquiries

All correspondence should be answered promptly This is particularly true of an inquiry received from a prospect for the first time If inquiries for chicks are being obtained through advertising in farm publications the cost of the inquiry may be from \$1 00 to \$2 00 or even more Because of the cost of the inquiry, it demands the best of attention to cut to a minimum the cost of converting an inquiry into a chick customer

When a large volume of inquiries is being received, it is physically impossible to give each inquiry a personal, typed answer For those who inquire only for a catalog which may have been offered in an advertisement, it may be possible to give them an adequate answer by sending a form letter which thanks them for their inquiry and encloses catalog and price list However, some inquiries ask specific questions and always where a specific question is asked an answer should be given Personal attention to small details is helpful in selling the prospect

All letters going to inquirers should constantly stress the quality of chicks being produced, should tell why the chicks being produced by the hatchery will prove profitable to raise A short paragraph about the hatchery's breeding and flock improvement program, bloodtesting, livability records, and other selling points can be worked into a regular inquiry letter that will back up any other advertising sent to the inquirer

Correspondence on management problems should be answered by someone who is entirely familiar with the subject This important task should not be assigned to an inexperienced person with a poultry textbook as reference The correct answer to management problems will do much to gain the confidence of the buyer This type of service helps make poultry raising more profitable for the customer and increases his respect and friendship for the hatchery

Complaints

Practically all hatcheries have complaints at some time or other Baby chicks are a highly perishable product if not handled correctly, and under improper conditions losses may be excessive The hatchery may or may not be at fault in the complaint registered However, regardless of the cause of the complaint, it should be handled in such a way as to keep the customer if possible, by arriving at some solution to the problem which is mutually agreeable with the hatchery and the customer A form for determining adjustments in the event of complaints is as follows

Complaint Form

Date______________________________

In order to give your complaint prompt attention please answer every question given below and return this sheet to us by return mail

Kind of chicks ordered?

Number ordered?

Number actually dead upon arrival?

Date received?

If any were not the breed ordered, give the exact number that were not the kind ordered and tell what breed they were

Have we made any previous refund on this order, and if so what?

If any chicks were in bad condition when you first received the box of chicks, explain just what was the matter

How much did you pay for the chicks?

What would you consider a fair adjustment?

Write any further remarks on a separate sheet, but please explain in as few words as possible

On some claims we require an affidavit, but you need not send us one at this time, since usually they are not required Please answer each of the above questions fully so that we can give your complaint an intelligent investigation We are always willing to adjust any reasonable complaint Your business is appreciated, and we desire to have you as a customer for years to come

Your Name	
Route	Box
Town	State

In adjusting complaints, all guarantees must be strictly adhered to By following guarantees made, and by approaching each complaint with a sense of fairness, the larger per cent can be settled satisfactorily and without loss of the customer, particularly when the chicks produced are actually of good quality Guarantees made by hatcheries are very similar in their content and guarantee satisfaction on certain specific points A fairly typical hatchery guarantee is as follows

Guarantees

No claims will be allowed other than listed below

Most of our customers are good chick raisers and seldom have any claim to put in If we grant adjustments not in keeping with our guarantees it is not fair to the good chick raisers who have no claims, as excessive refunds mean higher chick costs Therefore, in order to be fair to all we will be governed by the guarantees below

Very Important Since we cannot allow more than our guarantees allow, it simply delays matters when you ask for refunds not in keeping with our guarantees To get quick action be sure to place claim exactly in accordance with guarantees

100% Live Arrival of good, strong chicks, of the kind ordered, is made on all grades Should any be dead, crippled, or in bad order just have delivery agent make note of the number in such condition and mail us within 24 hours In case of express delivery have agent make notation on delivery ticket and send it to us We will refund in chicks, or money, for the full amount of such chicks

Two Weeks Replacements' Guarantee If you lose more than 5% the first two weeks we will replace all over 5% that you lose at one-half price provided you file claim within 15 days from date chicks are delivered This guarantee does not cover losses due to accidents overheating chilling, and improper feeding Regardless of cause of loss we cannot make adjustments greater than given here To ask for a greater adjustment simply delays your claim, as it cannot be honored Therefore, in order to prevent delay, be sure to file claim in accordance with guarantees

95% Sexing Accuracy on Pullets This applies to all grades We guarantee 95% sexing accuracy on pullet chicks Should you receive more than 5% cockerels we will refund the difference between price of pullets and

cockerels on all cockerels in excess of 5% Such claims must be filed within 90 days from time chicks are received No guarantee as to accuracy on cockerels

The most difficult complaints to handle usually involve some question concerning disease outbreaks or transmission of disease claimed to have originated with chicks purchased from the hatchery. This type of complaint can be of very serious concern to the hatchery The legal counsel of the American Poultry and Hatchery Federation has the following to say concerning legal basis of liability

Contrary to the impression of some people the hatcheryman's liability in cases of this kind is based upon that part of the law of contracts including sales relating to domestic animals rather than upon the law of negligence

In the absence of warranties, it would seem to make little difference whether the hatcheryman has exercised reasonable care and diligence in selecting his eggs or in conducting his hatchery practices From a practical point of view, however, warranties are likely to exist in connection with most sales and the care with which the baby chick stock is produced will be of considerable importance

Basically the hatcheryman's responsibility for sale of diseased chicks will arise in one of three ways (*a*) first, through a breach of warranty express or implied, (*b*) second, through fraud or deceit arising out of misrepresentations, or (*c*) third, through the violation of a statute regulating the sale of baby chicks

To minimize the risk of the customer collecting damages, the hatchery should follow all known bloodtesting, fumigation, and other good disease control measures Further, the hatchery should be in a position to back up advertising claims The "secret" of successful customer relations is summed up in the following from the APHF discussion of this subject

All in all if the hatcheryman tells the customer the whole story and does not conceal facts which the purchaser has a right to know, his risk in cases of this kind should not be too great

General

Hatchery correspondence in general should reflect the personality of the hatchery owner It should be friendly and to the point A study of letters received from successful business firms will give many hints of adaptations of phrases, words, and style of writing that will be helpful in building business letters which will make people enjoy dealing with the hatchery

STANDARD CHART OF ACCOUNTS FOR HATCHERIES

BALANCE SHEET ACCOUNTS

1—ASSETS
- 11—*Current Assets*
  - 111—Cash on hand
  - 112—Cash in bank
  - 114—Accounts receivable
  - 115—Notes receivable
  - 119—Inventories
- 12—*Fixed Assets*
  - 121—Land
  - 122—Buildings
  - 123—Equipment
  - 124—Autos and trucks
- 13—*Reserve for Depreciation*
  - 132—Buildings
  - 133—Equipment
  - 134—Autos and trucks
- 15—*Prepaid Expenses*
  - 151—Insurance
  - 152—Taxes
- 16—*Other Assets*
  - 161—Utility deposits
  - 162—Other deposits

2—LIABILITIES
- 21—*Current Liabilities*
  - 211—Accounts payable
  - 212—Notes payable
  - 214—Sales tax payable
  - 215—Unemployment tax
  - 219—Accrued payroll
- 22—*Deferred Liabilities*
  - 221—Customers' deposits

3—NET WORTH OR CAPITAL AND SURPLUS
- 31—*Capital*
  - 311—Capital stock or Owners' investment accounts
- 32—*Surplus*
  - 321—Earned surplus or Owners' drawing account

PROFIT AND LOSS ACCOUNTS

4—*Sales*
- 401—Chicks—Local
- 402—Chicks—Outstate
- 403—Eggs
- 404—Equipment and remedies
- 405—Feed
- 406—Other
- 407—Custom hatching

5—*Purchases*
- 501—Hatching eggs
- 502—Chicks bought
- 504—Equipment and remedies
- 505—Feed bought

6—*Expenses*
- 601—Hatchery supplies
- 602—Salaries and wages
- 603—Heat power and water
- 604—Repairs and maintenance
- 605—Hatchery general expense

6—*Expenses (continued)*
- 606—Shipping boxes and pads
- 607—Parcel post and express
- 608—Truck and delivery expense
- 609—Advertising
- 610—Rent and insurance
- 611—Telephone and telegraph
- 612—Tax expense
- 613—Office supplies and expense
- 614—Refunds to customers
- 615—Donations
- 616—Bad debts

7—*Other Income*
- 701—Interest received
- 702—Discount taken
- 709—Miscellaneous

8—*Other Deductions from Income*
- 801—Interest paid
- 802—Discount allowed

Courtesy American Poultry and Hatchery Federation, Kansas City, Mo

STANDARD BOOKKEEPING SET FOR HATCHERIES

American Poultry and Hatchery Federation

This standard bookkeeping set for hatcheries is designed to provide a complete set of accounting records in one binder for the average hatchery The set contains the following records

1 Record of Cash Received—6 sheets—12 pages
2 Record of Checks and Cash Paid Out—12 sheets—24 pages
3 Bank Reconciliation—3 sheets (Each page may be used for four months)
4 Order Register—12 sheets
5 Insurance Record—2 sheets
6 Record of Buildings Machinery and Equipment Owned—3 sheets
7 Notes Register—2 sheets
8 Inventory Record—2 sheets
9 One Binder
10 One Set of Dividers post lock key and extension posts

It is estimated that this supply will provide for a full year s record for the average hatchery Additional sheets of each form may be ordered as needed from the International Baby Chick Association in the quantities shown at the lower right and at prices indicated

INSTRUCTIONS

General This set has been designed for use either in conjunction with or without a general ledger In cases where a general ledger may be used by the hatchery a chart of accounts is included therewith and instructions for posting to the general ledger accounts have been provided at the bottom of each page of the cash received and check and cash paid out forms Ordinarily this should be used by hatcheries above 100 000 capacity

In cases where the set is used without a general ledger the instructions re 111 Dr etc may be ignored In such cases it is suggested that the totals be carried forward from page to page until the end of each year thus providing a ready summary of the business for the entire year

Record of Cash Received Each day the register tickets order blanks or other records of cash received should be added and the total amount of cash received for the day should be entered in the Total Cash Received column of the form The total amount collected for each class of sales should then be determined and entered in the respective columns under the heading ' Hatchery Sales Any other cash received such as money put in by the owner interest collected proceeds of sales of old hatchery equipment etc should be entered in the Other Cash Received column with an appropriate explanation in the Account column The amount entered in the Total Cash Received column should equal the sum of the amounts entered in all other columns except the Bank Deposit column *The latter column is provided for use only when a general ledger is maintained by the hatchery or as a memorandum record of amounts deposited in the bank*

STANDARD BOOKKEEPING SET FOR HATCHERIES (Continued)

Record of Checks and Cash Paid Out Cash paid out each day should be summarized and total amount should be entered in the "Cash Paid Out" column The detail of the various items making up the total should be entered under the respective column headings Any amounts used by the owner for personal expenses should be entered in the column headed "Owner's Withdrawal" Such items are not expenses of the business and should not be so classified

It is suggested that where a series of consecutively numbered checks are drawn for the purchase of hatching eggs, *only the total thereof be entered in the "Amount of Check" and "Hatching Eggs" columns* In all other cases each check should be entered separately on the record showing the date, the name of the person to whom the check is drawn, the check number, and the total amount of the check. *The amount should then be entered in the column provided for that* type of expense i e a check for five dollars in payment of a water bill would be entered in the amount of check column as $5 00 and then be shown in the "Heat, Power, and Water" column as $5 00

As each page of the form is completed all the columns should be added The totals should then be proved as follows The total of the "Amount of Check" and "Cash Paid Out" columns should equal the total of all other columns

Order Register An *order register sheet should be prepared for each hatch* to be set As orders are received each order should be entered in detail on the left hand page of the register The "Delivery" column is left open to be checked as the orders are filled and shipped to the customer The number of chicks ordered should be entered in the column provided under the respective breed and grade on the opposite page The number ordered should then be deducted from the estimated hatch shown at the top of the column and the unsold balance entered in the column provided As the orders are entered the number should be deducted from the previous unsold balance thus providing a quick reference as to the available number of chicks of each breed and grade to be booked

Prior to shipment of a hatch the order register may be reviewed to insure that all balances due on orders have been received Then as shipments are made, a check should be placed in the Delivery column to record that each order is shipped

STANDARD BOOKKEEPING SET FOR HATCHERIES (Continued)

the current month. Any deposits not appearing on the bank statement should be entered on the form and the reconciliation can be completed. In this connection it is suggested that any deposits which do not appear on the bank statements within a few days after the check stub book entry should be brought to the attention of the bank for investigation.

Insurance Record. The insurance record is provided as a permanent record of insurance carried by the hatchery as well as a ready reference sheet from which the hatchery owner can obtain a quick summary of insurance in force. The information to complete the form can be obtained from insurance policies purchased.

Record of Buildings, Machinery and Equipment Owned. This form has been designed as a permanent record of fixed assets owned by the hatchery. Space has been provided thereon to enter the depreciation each year and the final disposition of the asset. This record will provide all the necessary information required for depreciation schedules on annual income tax returns and should be retained as long as the business is operated or until final tax returns have been examined.

Entries should be made on the form each time additional equipment is acquired and whenever an item of equipment is sold, abandoned, or otherwise disposed of. At the end of each year the depreciation for the year on each item owned should be determined and entered in the column for the year. The column "Total" represents the amount of depreciation to be entered on the tax return. The amount of depreciation to be taken on an item acquired or disposed of in the year should be prorated in that year.

Note Register. This is a combination form to record the amounts of both notes payable (borrowed money) and notes receivable (money loaned). It is suggested that when the volume of notes handled is very large separate pages should be used, one for notes receivable and one for notes payable. Entries should be made on the note register as soon as a note is issued or received. When final payment has been made or received on a note, the note should be marked off by drawing a line through the amount of the note.

Inventory Record. This form is provided to be inserted in the binder after inventories are completed. It is suggested that inventory items be listed directly on the sheets as the inventory is taken. Care should be exercised to insure that adequate descriptions are entered in order that the inventory will be properly priced. For example, in inventorying feed, the item column should show the make and type of feed and the size of the sack, i.e., 100 lb. sacks. The amount to be entered in the "Number of Items" column should then represent the number of 100 lb. sacks and not the number of pounds.

After entering the cost of each item, the total cost should be obtained and the columns totaled to determine the value of the inventory.

15

Chick Delivery Methods

The development of commercial hatcheries has made it necessary for chicks to travel Baby chicks, when ready for delivery to the customer, are either picked up at the hatchery by the customer, delivered by auto transport, shipped by rail or parcel post if the customer is located at a distance, or shipped by air in the event of extra long distance or overseas shipment

Parcel post is the most common method of transportation but truck travel is gaining in popularity, especially since the advent of the broiler

FIG 15–1 Truck shipments of chicks are becoming more important as a means of delivering chicks to customers (Courtesy Hubbard Farms Walpole N H)

chick business which may call for thousands of chicks to be delivered to a single customer Air shipments, once widely used by hatcheries, were curtailed first by World War II restrictions on air travel and then by the greatly increased air rates which made the air shipment of baby chicks almost prohibitive Some hatcheries which make large shipments of chicks into certain areas, obtain the services of a private plane flying service, and have their chicks delivered direct to the customer by air without the necessity of changing air lines and without delays such as might occur on regular scheduled commercial flights

Such private planes may frequently be chartered at a reasonable cost where large shipments are involved

Regardless of the method of transportation, the chicks should be shipped in roomy, well ventilated boxes, be properly labeled and tied for rail or air shipments, and should be shipped on a schedule which will assure delivery within 60 hours after hatching

Rail Transportation

Although shipment by rail still remains a widely used method of transportation, it is being rapidly curtailed as a result of the tendency of railroads to abandon branch lines and eliminate local stops Continued curtailment of rail service and a preference among large buyers for truck deliveries will no doubt lead to less use of rail service as a method of delivering chicks in the future Despite the trend toward fewer trains however, hatcheries shipping by rail report reasonably good service and ability to ship into the more distant zones with success

The decrease in the number of mail carrying trains is due almost entirely to discontinuance by railroad companies of service on branch or side lines and many trains on the trunk or main lines A 4 year table on the number of trains operating, as reported by Boles (1952), presents the following facts

In 1925 there were 19 404 mail carrying trains
In 1940 there were 9 563 mail carrying trains
In 1945 there were 8 830 mail carrying trains
In 1950 there were 6 794 mail carrying trains

With fewer trains to carry chicks by parcel post, the Post Office Department has let contracts to private truck operators with the understanding that they will furnish equipment which will give adequate protection to perishable shipments such as baby chicks

In October 1951, the Post Office Department issued specific instructions concerning the heating and ventilating of trucks as a protective measure for the baby chick traffic These were in part as follows

> According to tests conducted by officials of the Department of Agriculture baby chicks which have a body temperature of about 100°F will withstand cold weather for a short time better than hot weather
>
> Since the chicks will retain body heat for a considerable time but can not survive temperatures in excess of about 106°F without ventilation it is essential that air space be provided in two sides of the boxes and that the trucks not be packed solidly except possibly in cold weather when transit time does not exceed one hour or so If a truck is stalled on a hot day, it

may be necessary to remove boxes from the truck to a place not in the sun and shift other boxes in the truck so as to provide air space on all four sides thereof

Normally a few inches of air space on two sides of the boxes is adequate, and the air space should be from front to back in the truck Temperature in the top of the truck will be greater than on the floor and loading of chicks near the top should be avoided so far as practicable during hot weather

Chicks will begin to peep loudly at temperatures slightly over 100°F which may be considered a warning that ventilation must be checked Brooding temperature is at 90°F

Temperatures of 40°F will be tolerated for three or four hours, since temperatures inside the boxes will probably be around 60°F Chicks which are chilled or overheated on the initial dispatch will be more susceptible to other subsequent temperature changes

Trucks with heating facilities should not be heated to a temperature over 70°F during cold weather

It will be noted from the foregoing that ventilation to prevent overheating is of primary importance, and it appears that trucks used for these shipments must be properly ventilated

Heating during cold weather is of secondary importance especially since chicks will maintain body temperatures for short periods of time and there may be some question as to whether heating facilities should be a requirement generally

The foregoing instructions and specifications were based on the understanding that transit time by trucks would not usually exceed 2 to 4 hours and that baby chicks would not ordinarily be dispatched during freezing weather or during the extremely hot summer months

Boles further reports that postal clerks are required to submit a report when railway employees fail to handle chicks properly, as follows (1) when chicks are not properly protected against the elements, (2) when chicks are covered with bags of mail to the extent of preventing adequate ventilation, (3) when boxes of baby chicks are so piled in cars that a minimum of approximately 4 inches of clear space under normal conditions or 6 inches during hot weather, is not maintained between the boxes and sides of the car and between each pile of boxes, (4) when boxes of chicks are piled more than 10 high under normal conditions or more than 7 high during hot weather, (5) when chicks are placed too near heated radiators or steam pipes

Hatcheries have overcome some of the difficulties of rail shipments by working closely with postal and express officials A group of hatcheries in Michigan has obtained the services of an expediter, who meets the train at the Chicago terminal and sees that the chicks are promptly transferred to the proper trains and protected from the weather ele

ments when necessary Retired postal or express employees may be hired by a group of hatcheries at terminals to help assure prompt handling of rail shipments at points where there are frequent delays Such services by an informed and interested person can be helpful in assuring delivery of chicks in good condition and increasing customer satisfaction with mail order chicks

Truck Transportation

Truck transportation can be economical when properly handled It may, however, be costly to the hatchery that does not pay careful attention to truck maintenance, size of pay loads related to distance of delivery, and other essentials of successful truck operation

The following instructions and notes on truck movements of chicks, which one hatchery organization follows, points up some of the problems of truck transportation

1 Circulation of air seems to be the most important single factor Maintain temperature between 70 and 75° if possible, but continue the circulation regardless! Fresh air must be circulated, whether heating or cooling

2 In less than capacity loads, stagger the stacks of boxes through the truck to give better ventilation to as many sides of the stacks as possible

3 In capacity loads or in warm weather, use open or screened lids Open lids may have 1 foot or more square cut from the center of the lid

4 In hot weather, start putting only 80 chicks per 100 size box earlier than is normally done for rail shipments Oversize chick boxes will provide more room and ventilation for the chicks

5 Have truck preheated or precooled before loading Have invoices, driver, and truck all ready for the trip before loading chicks

6 If more than one grower, dealer, or breed is involved number invoices and corresponding chick boxes Stack all boxes in truck so that number, sexing and vaccinating stickers are facing unloading direction

7 In extremes of heat or cold, use false door with canvas flap at bottom to maintain temperature in truck and pass chicks through it, especially when unloading

8 For long distance hauls, truck floor should be covered with duck boards set on rubber to cushion vibration and improve air circulation

9 On distance hauls, carry a few extras in a separate box for each order Go through boxes before arriving at destination and replace dead or weak chicks

10 Advise dealer in advance of approximate time of arrival If delayed, wire him

11 If truck is used for any hauling other than chicks, such as for eggs, fumigate before loading and allow to air thoroughly before loading chicks

12 Keep truck washed and in good repair Clean inside after each delivery Driver must be neat and courteous at all times

may be necessary to remove boxes from the truck to a place not in the sun and shift other boxes in the truck so as to provide air space on all four sides thereof

Normally a few inches of air space on two sides of the boxes is adequate and the air space should be from front to back in the truck Temperature in the top of the truck will be greater than on the floor, and loading of chicks near the top should be avoided so far as practicable during hot weather

Chicks will begin to peep loudly at temperatures slightly over 100°F which may be considered a warning that ventilation must be checked Brooding temperature is at 90°F

Temperatures of 40°F will be tolerated for three or four hours, since temperatures inside the boxes will probably be around 60°F Chicks which are chilled or overheated on the initial dispatch will be more susceptible to other subsequent temperature changes

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Boles further reports that postal clerks are required to submit a report when railway employees fail to handle chicks properly, as follows (1) when chicks are not properly protected against the elements, (2) when chicks are covered with bags of mail to the extent of preventing adequate ventilation, (3) when boxes of baby chicks are so piled in cars that a minimum of approximately 4 inches of clear space under normal conditions, or 6 inches during hot weather, is not maintained between the boxes and sides of the car and between each pile of boxes, (4) when boxes of chicks are piled more than 10 high under normal conditions, or more than 7 high during hot weather, (5) when chicks are placed too near heated radiators or steam pipes

Hatcheries have overcome some of the difficulties of rail shipments by working closely with postal and express officials A group of hatcheries in Michigan has obtained the services of an expediter, who meets the train at the Chicago terminal and sees that the chicks are promptly transferred to the proper trains and protected from the weather ele-

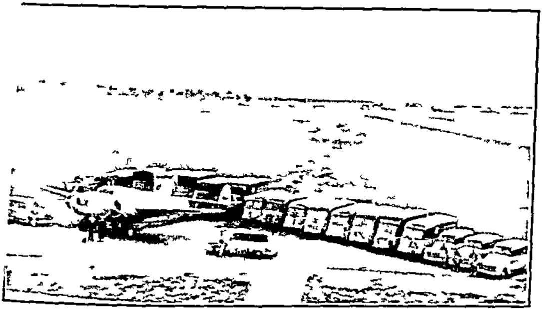

Fig 15–4 Several types of transportation in use by modern hatcheries including plane school bus vans vanettes panel trucks and carry alls (Courtesy Corn Belt Hatcheries Joliet Illinois)

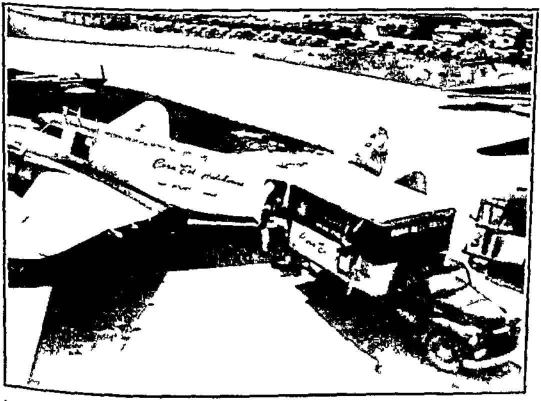

Fig 15–5 Chicks being loaded from delivery truck to plane at the airport for delivery to a distant customer (Courtesy Corn Belt Hatcheries, Joliet, Illinois)

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The racks are removable so that we can also pick up eggs, etc., with the same truck.

We have always made a practice of cutting the back out of the cab of the truck so that the driver may drive with his chicks, which is the best safeguard you have as long as you have good drivers.

Except on very large loads, where we sometimes have to pile a few boxes down the middle, we allow plenty of room for the driver or his assistant to

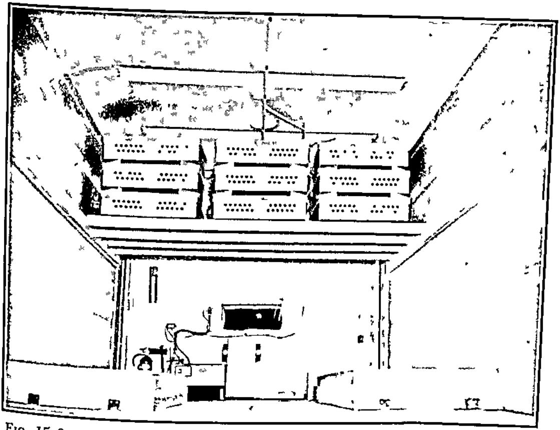


FIG 15-3 Interior of Calhoun Hatchery chick delivery truck, showing equipment for heating, ventilating, and stacking chick boxes The automatic butane gas heating system can be controlled to within 5 degrees of any set temperature (Courtesy Calhoun Hatchery, Montrose, Missouri)

move up and down the aisles, checking the boxes, because in this system you can check any individual box without moving others to get to it.

We have 5 fin-type ventilators on the front of the body, 2 high along each side, and 2 low along each side We also have panels on the back of the truck, which in warmer weather can be removed to allow free movement of air directly through the truck while moving

With boxes spaced in this manner, you can stop the truck in case of breakdown or for other reasons, and not have to worry about overheating except on extreme days. In New England, our climate is as probably extreme, from extremely hot to extremely cold in the course of a year, as anywhere in the country, and this type of transportation might not fit in an area where it is extremely hot practically all the time.

13 In hot weather, hatch chicks so that they may be graded and counted and loaded out early They should be delivered to the grower not later than 8 or 9 A M and earlier in very hot weather It may be more desirable to deliver at night in extremely hot weather

14 Driver should tactfully collect payment for load upon delivery

15 Train driver carefully on all points of truck service He must know when to use heat and when to use cooling to keep the chicks comfortable The driver's important job is to deliver chicks that are in good condition and to maintain customer good will

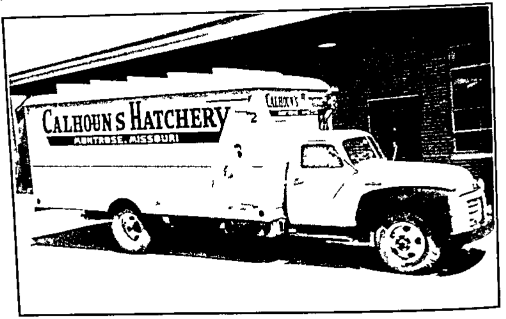


Fig 15–2 This large chick delivery truck has a capacity of 22 000 chicks per load Note the side loading door, the air scoops on top of the truck and the gasoline motor mounted on the front of the truck which operates the motor driven air-circulating fan inside the truck independent of the truck motor (Courtesy Calhoun Hatchery, Montrose, Missouri)

Rack Transportation System Hatcheries that haul chicks for long distances have found that racks in the truck provide better ventilation and permit the chicks to ride comfortably with adequate air circulation around the boxes

Cobb (1952), describing the rack transportation system used by his hatchery, writes as follows

Our rack transportation system was evolved over a long series of trials and the basic idea behind it was to separate the boxes to allow ventilation completely around them There is at least a 3 to 4 inch space between each box as they're placed in the truck It is not efficient from the point of view of space However, the racks are on each side of the body, and a 19 foot body truck can carry approximately 20 000 chicks in this manner

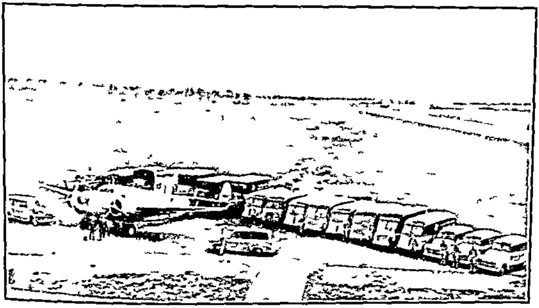


Fig 15–4 Several types of transportation in use by modern hatcheries, including plane, school bus, vans, vanettes, panel trucks, and carry-alls (Courtesy Corn Belt Hatcheries, Joliet Illinois)

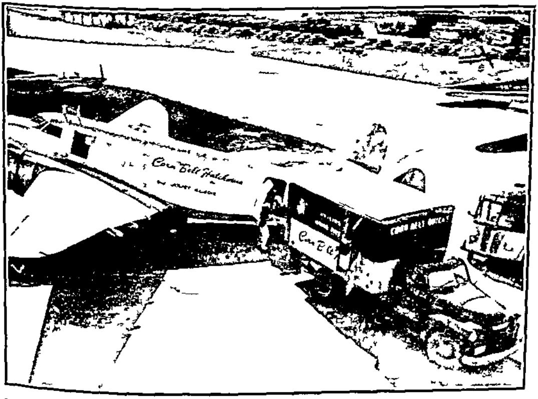


Fig 15–5 Chicks being loaded from delivery truck to plane at the airport for delivery to a distant customer (Courtesy Corn Belt Hatcheries, Joliet, Illinois)

In cold weather, the body of our truck can be completely closed and ventilated only through the 5 ventilators on the top, which will take off the excess heat, and, of course, natural body leakage will bring in as much fresh air as you would need on extremely cold days

The major thing, of course, is the ability of the driver to determine when his chicks are too hot or too cold, and, without him, I doubt if there is a 100 per cent foolproof automatic system in the country

Most hatcheries tend to have trucks that are too big for them anyway If you are hatching 40,000 chicks in a hatch, I see no reason to have one great big truck to haul 40,000 chicks The chances are that they are not all going to the same person anyway, or even in the same area in most cases

We hatch 140,000 a week and have 5 trucks to deliver Since one of them may go to Maine, another to western Massachusetts, another to Vermont, and another to Connecticut, our loads usually don't average more than 12,000 to 15 000 at a time Occasionally, you might have to send two trucks to the same general area, but it gets your chicks off earlier and under the stoves, rather than making one man make six or seven deliveries

Truck Ventilation The requirements for ventilation of chick truck bodies have evolved largely through a system of trial and error by various hatcheries Correct and adequate ventilation is essential at all times to assure delivery of chicks in good condition

For winter delivery, the tendency of inexperienced persons who attempt truck deliveries is to overheat and underventilate the load Many trucks use an alarm system to warn of overheating, the drivers check the load at hourly intervals to assure correct heat and ventilation Some hatcheries have experienced problems with carbon monoxide poisoning of chicks caused by exhaust fumes from the truck filtering into the truck body This should be checked carefully before a new truck is put on the road

For summer delivery, plenty of air circulation is essential to move away the heat that is given off by the chicks in the boxes Since the baby chick does not sweat, the circulation of air does not cool the chick by evaporation as many seem to believe, but air circulation does move the hot air away from the chick Some hatcheries employ ice or commercial refrigerating systems in the summer to keep the chicks cool When the truck temperature is maintained at 75°F by cooling, less air circulation is needed to keep the chick comfortable

Any heating or cooling system should be operated by a motor or other means independent of the truck motor Temperature control systems that depend on the truck motor for operation may become ineffective if the truck develops motor trouble or for other reasons is forced to stop

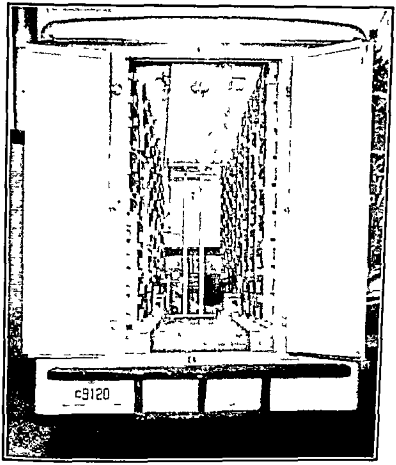


FIG. 15-7. Inside of chick truck body Note manner of loading and holding boxes in place with flexible spring supports. Also note that back of truck cab is cut out to allow driver to constantly check on temperature and condition of the load (Courtesy Nichols Poultry Farm, Kingston, N. H)

The truck body developed and patented by Davis (Fig. 15-7) has a ventilation system which directs a flow of air from floor to roof of the interior of the truck. According to Davis, this system

accelerates the natural rise of warm air. The flow is short, direct, and easily controlled. Most important, the air is caught by the box cover, by-passed into the box, and the main stream of air continuing upward sets up a suction at the top of the box, which sucks the by-passed air up through the box cover and out into the main stream again.

A controlled and even distribution of air is maintained in the Davis-designed truck body by the following means:

On the floor of the truck body are two ducts, each one measuring about one-third the width of the body. On each side, at the top of each duct is a slot, discharging air straight up, with the result that 4 vertical walls of air

FIG 15–6 Interior view of plane being loaded with baby chicks Hatchery owner at left checks the loading and count of boxes for each customer. (Courtesy Corn Belt Hatcheries, Joliet, Illinois)

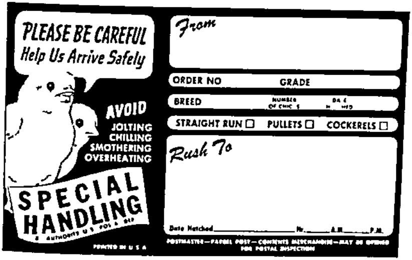
One of the most careful studies of truck body requirements for correct ventilation of baby chicks has been made by Davis (1951). Some of the requirements of successful chick truck body design according to Davis are:

1. Above all, it must be dependable.
2. Effective at extreme summer and winter temperatures.
3. Easy to control.
4. Easy to understand.
5. Easy to load and unload.
6. Ability to load assorted sizes of boxes, eggs, etc.
7. No dehydration of the birds.
8. Driver must have means of knowing at all times conditions in the truck body.

are established from front to back of the body, between which the chicks are placed At the ceiling are 4 more slots, each one sucking air at the same rate that the slots in the floor are discharging it Thus, the 4 walls of air are controlled from floor to roof, and all 4 compartments of all boxes receive the same amount of air, at the same speed, volume, and temperature

The system is a dual system It will take all air from the outside, pass it through the load and discharge it to the outside, which is done in the summer Or it will circulate the air through the load and pass it back to the heating units again, taking only enough outside air to keep the inside atmosphere fresh, which is done in winter It will operate at any point in between A damper controls the dual function

The advantages of the above system, as listed by Davis, are no dehydration of the chicks, even air flow throughout, ease of temperature



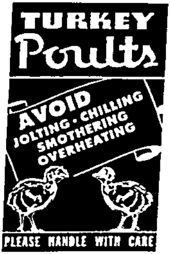


FIG 15–10 Regardless of the method of transportation, an informative and attractive label with instructions on proper handling is helpful in assuring speedy delivery to the customer (Courtesy American Poultry and Hatchery Federation)

control, good heating ability for small loads, controlled air flow, moving or standing still, 90 per cent effectiveness with either of the two blowers, 6 to 7 hours' operation from the batteries in the event of complete

FIG 15–8 Truck design may have to be altered for different sections of the country The above shows types of transportation in use by a Southern hatchery (Photo courtesy Oak Crest Poultry Farms Jacksonville, Florida)

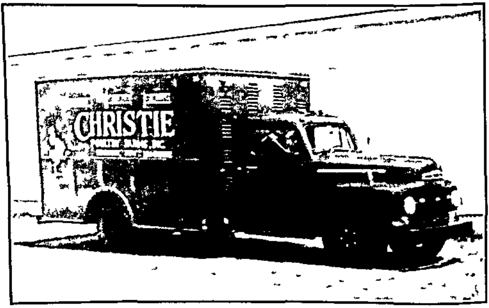
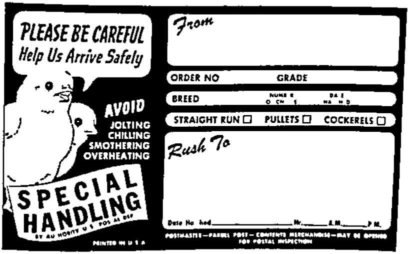


FIG. 15–9 Chick transport truck with capacity of 20 000 chicks per load It is completely insulated, has heating as well as cooling equipment, automatic sanders for travel over ice in winter, etc Note ventilation slots on front and sides of truck. (Courtesy Christie Poultry Farms, Kingston, N H)

are established from front to back of the body, between which the chicks are placed At the ceiling are 4 more slots, each one sucking air at the same rate that the slots in the floor are discharging it Thus, the 4 walls of air are controlled from floor to roof, and all 4 compartments of all boxes receive the same amount of air, at the same speed, volume, and temperature

The system is a dual system It will take all air from the outside, pass it through the load and discharge it to the outside, which is done in the summer Or it will circulate the air through the load and pass it back to the heating units again, taking only enough outside air to keep the inside atmosphere fresh, which is done in winter It will operate at any point in between A damper controls the dual function

The advantages of the above system, as listed by Davis, are no dehydration of the chicks, even air flow throughout, ease of temperature



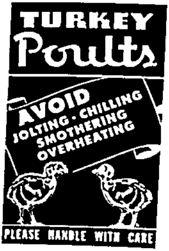


FIG 15–10 Regardless of the method of transportation an informative and attractive label with instructions on proper handling is helpful in assuring speedy delivery to the customer (Courtesy American Poultry and Hatchery Federation)

control, good heating ability for small loads, controlled air flow, moving or standing still, 90 per cent effectiveness with either of the two blowers, 6 to 7 hours' operation from the batteries in the event of complete

generator failure, batteries easily obtained anywhere, dual wiring system gasoline, gas, or electric heaters may be placed anywhere in the truck without affecting the system should the truck engine fail, each wiring system and motor individually protected, truck may be loaded in any manner, as long as air slots are not covered

A variety of box sizes may be carried at one time, all equipment is easy to service, damaged parts are easily obtained, the driver is constantly aware of temperature and ventilation conditions in the body of the truck, and the system is easy to understand and is dependable

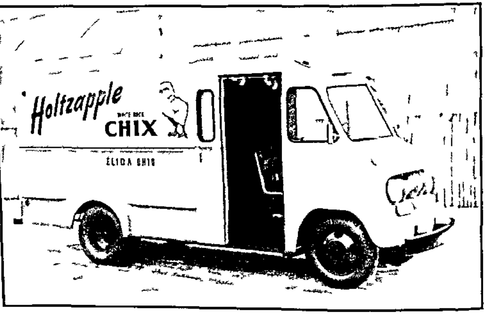


FIG 15–11 This vanette type truck body was specially designed for baby chick delivery service (Courtesy Herman Body Co, St Louis Missouri)

Several companies that manufacture truck bodies have become interested in developing bodies for chick delivery trucks (Figs 15–11 and 15–12) As these concerns continue to study the problems of truck delivery and develop better systems of ventilation and heating control we shall see increased use of trucks as a means of delivery

The Driver Truck deliveries of chicks have created problems for hatcheries which were never encountered when rail shipments of chicks were the chief mode of delivery The fact that many of these problems are new and previously not encountered means that no set pattern of solution has been worked out for other hatcheries to follow

The driver of the truck must understand from the behavior of chicks whether or not they are comfortable He must be interested enough

in his job to check his load carefully at frequent intervals during the course of the journey to the customer's brooder house. He must know and understand truck maintenance, servicing, and load limitations, so as to keep down repair and maintenance costs. He must have a good appearance and be informed and interested enough to impress the

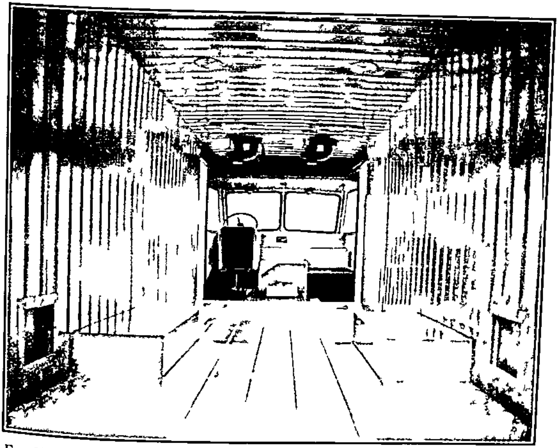


FIG 15-12 Interior view of vanette type truck body shown in Fig 15-11. Note the adjustable exhaust openings and the fans for air circulation attached to the ceiling. (Courtesy Herman Body Co., St. Louis, Missouri.)

customer favorably. He must be firm and tactfully persistent in his collection for each load of chicks upon delivery.

The driver should not be required to drive for excessive periods of time. He should be allowed adequate time for rest to avoid accidents resulting from driving fatigue.

State laws for trucks should be checked to learn requirements for insurance, clearance lights, mud guards, directional lights, flares and flags in the event the truck is required to stop for repairs, etc. Such information can be obtained from the highway patrol or at state port of entry.

Air Transportation

Air transportation is safe and efficient, but since World War II relatively costly, as air shipping charges have continued to increase.

Chick boxes shipped by air are figured at their weight and on the basis of the room taken up, when determining the transportation charges of a shipment. For example, the air shipping weight of a box of 100 chicks, weighing 12 pounds actual weight, would be figured at 17 pounds air shipping weight because of the space required by the box, which includes the height of the spacing stick as well as the width, depth, and length of the box.

Airlines usually have a minimum charge for shipments. Frequently, two boxes of 100 chicks each can be shipped at the same price as a single box shipment. Single box shipments should be avoided if possible because of the extra costs. However, it may be desirable to ship very valuable chicks or chicks destined for contests by air. If the plans are to make regular shipments by air, the costs of various size shipments should be determined in advance. Shipping costs per box of 100 chicks are much lower on the large shipments, where a number of boxes are shipped.

To improve their agricultural production, countries in Europe, Asia, South America and the Caribbean areas have been showing an increased interest in chicks bred and produced in the United States. The only way to get chicks overseas is to ship them by air, and a greater number of airlines are making special provisions so that they can properly handle chick shipments.

According to *Hatchery and Feed* (1952), the following airlines are currently making chick shipments out of New York City:

KLM Royal Dutch Airlines. Air cargo shipments to Europe and Asia. New York office at 572 Fifth Avenue, New York 36, N. Y.

Riddle Airlines. Shipments to Miami, Puerto Rico, Cuba, Venezuela, and Colombia. Address 235 West 46th Street, New York 36, N. Y.

Guest Airways. Shipments to Mexico via Miami. Address 60 East 42nd Street, New York 17, N. Y.

There are other airlines either now making overseas shipments or planning to do so. Some have limitations on the number of boxes of chicks they will accept. This should be thoroughly understood before shipment, or the airline may arbitrarily refuse to accept shipment at some point of transfer, thus causing loss of the entire shipment. Unless some prior understanding and agreement has been reached between

the shipper and the airline, it may be impossible for the hatchery to collect damages if the shipment is lost because of lack of cargo space at some point in transit.

Overseas air shipments should be made so that time in the air and ground time at points of transfer do not total more than 72 hours in transit. A few successful foreign shipments have been reported where transit time was 90 hours, yet the chicks arrived with a loss of only 5 out of a shipment of 408 chicks. Chicks have been successfully shipped by air from the Middle West of the United States to Germany, Italy, and other points in Europe, to Venezuela and other South American countries, and to Japan; a great many shipments are made annually to nearby Mexico.

Air shipments to foreign countries require 4 copies of an export declaration, which may be obtained from the airlines, 1 copy of a health certificate (hatcheries participating in the National Poultry Improvement Plan may use a certified copy of the sales report for this), a letter of instruction, and 3 copies of the invoice with value of the shipment and description. Some countries may require a special report from a state veterinarian on the health of the chicks, with respect to pullorum or Newcastle or other respiratory diseases. A check should be made to determine any special health requirements of a particular country. Some accept only chicks from U.S. Pullorum Clean flocks. Others have various other requirements.

Because of the hazards of overseas transportation, with particular reference to the time in transit, it is not usually advisable to make foreign shipments with the same 100 per cent live arrival guarantees as are made in the United States. It may even be desirable to make foreign shipments at the buyer's risk.

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tively presented claims, the source of supply of stock The general farmer of course has the same problem, but his investment in poultry may be modest, his requirements may be met with cheaper chicks, and his annual income depends only to a small extent on the rightness of his choice of stock To the commercial operator the question is much more serious, for he cannot withstand a succession of serious mistakes and still make his living from poultry

It is surprising, then that among the welter of information available to the poultryman on nearly every management problem he may face, there is so little on the vital subject of the choice of supplier There have been many recommendations made in the past on the choice of breed but the choice within the breed is at least as important and little has been done about it The reasoning behind this deficiency seems to be that there is nothing the commercial operator can do about the genetic potentialities of his flock He may build new houses, change diets, vaccinate his birds, but the inheritance of his birds is fixed before the chicks reach him This is of course the very reason why he should have information on their breeding Only when he is in a position to discriminate between claims made for the different sources of supply, can he form any kind of beforehand judgment

In the final analysis the only test which poultry have to pass is that of making money for their owners No amount of previous information will settle this question Hence, when a poultryman wants to change his supplier, the best thing he can do is to conduct an experiment He should buy stock *simultaneously* (not at different times of the year) from both the old and the new sources provide the groups with as uniform environment and care as possible and draw his conclusions from the comparative cost accounts Such experiments even on a small scale may be desirable throughout the poultryman's career, because a single source cannot supply chicks of uniform quality year after year, and trends of improvement or deterioration will change the relative values of different strains in the course of several years

EVALUATING QUALITY

Because of the difficulty in accurately interpreting advertising claims and because advertising is frequently designed more for the purpose of attracting inquiries than to give detailed information, the buyer of chicks must frequently look to other sources of information for the facts he needs before he buys The hatcheryman selling chicks may also desire some yardstick to give him an idea of just how well his chicks compare in performance with those sold by his competitors For chick buyer or hatcheryman, performance results for quality comparison can be obtained by (1) results on the farms of customers of the hatchery, (2) Standard egg laying tests, (3) Random sample egg laying tests, (4) Random sample meat performance tests (5) official poultry improvement program records, and (6) perhaps to a much lesser extent from chick and egg shows, and meat shows where dressed birds are

16

Measuring Chick Quality

Chick quality is a combination of desirable traits that gives the chick buyer the results he seeks. A quality chick purchased for egg production purposes is very likely not a quality chick for meat production purposes. Chick quality starts first with specialized breeding for the purpose desired, whether it be for meat or for eggs, or a dual purpose type giving reasonably good performance in both meat and egg production.

In addition to the bred in factors for egg or meat production as desired, chick quality also means that the chicks are free of pullorum disease, well "fluffed" with long down, cleanly hatched and of good weight, with full sturdy shanks, uniform in appearance, and with well healed navels. Chicks of this type, with vigor apparent in their bright, alert eyes, and general activity, are the kind that give customer satisfaction.

Vickers (1953) states,

> the process of buying baby chicks is a more important factor in determining profits than many people suppose. When chicks are hatched their potentialities are already determined. You or no one else can change this. If you secure poor chicks you are stuck, and there is nothing you can do to change their genetic make-up. Good management will get the best out of the potentialities present but if not much is there to build on there isn't much hope of making any profit.
>
> So about half the battle is going to be determined by the kind of chicks you get. This being true, doesn't it make sense to be careful what kind of chicks you get and where you get them? You can't take them back and exchange them after you see they are not heavy layers of good quality eggs. Your profits to an important extent are going to be determined when you place your order for chicks. So look before you leap.

Lerner (1951) comments on the problem of choosing a reliable source as follows:

> The commercial poultryman who operates either a specialized egg producing farm or a broiler plant must choose, on the basis of many attrac

hibit heterosis, whereas the commercial poultryman may be sold chicks from one of the strains which were used in the cross but which are unexceptional in themselves

Dryden (1952) commented

the Standard tests were never intended to be anything but a simple test between the best birds of various breeders under uniform conditions of feeding and management I think much of the criticism of the Standard tests has been unjustified and illogical It is not logical for example, to assert, as some critics have, that luck is a determining factor in the results of these tests and, in the next breath, to claim that it is an easy matter for any breeder to "select" his star pullets at the beginning of production The factor of selection has been grossly exaggerated as proven by the fact that in the entire history of Standard tests very few pens have been entered that averaged as much as 300 eggs and the general average for all pens in each test is quite low annually I wish someone would tell me how to select nothing but 300 egg hens for contests

There is no doubt that luck plays an important part in single pen winnings but averages covering many pens entered over a period of years should carry some significance

Standard egg laying tests comprise 13 mature pullets per entry, and each individual in the pen is trapnested daily for a period of 50 weeks With high labor costs, there has been a trend away from individual trapnesting and toward either bulk gathering and weighing of eggs or the Random sample type laying test which does not require individual trapnesting under present plans

Random Sample Laying Tests

The Random sample test is an attempt to get an unculled production average of a supplier's flock According to Lerner (1951),

in general an unculled production average for the supplier's breeding flock is as good an index of merit as the prospective buyers of chicks for egg production can have Of course information on factors other than the production index such as egg size and quality, should be obtained

Marble (1953), in a discussion of some of the differences between Random sample and Standard laying tests, states,

a Random sample might be defined as a cross section of a strain The object is to obtain a sample which includes in it all graduations of quality in the same proportions as the entire population Possibly I can explain it by a simple explanation

Suppose we have 5 000 laying hens mated for production of hatching eggs If we save eggs for one week and hatch them rear all the pullets to maturity, and then trapnest all the pullets without any culling, we will

judged on carcass quality and appearance such as in the state Chicken-of Tomorrow tests

Customer Results

The performance of chicks in the hands of customers as evidenced by testimonials may or may not be a reliable index of what to expect from a source of supply However, farm records kept in conjunction with the county agent s office or some other unbiased supervision do have merit Farm records show what kind of performance a certain strain will give under farm conditions Frequently stock will perform rather well under ideal conditions of management, but when subjected to conditions that are less than ideal, such as are found on many farms where poultry is only a sideline enterprise, these strains do not fare so well and do not live up to expectations

There has been some discussion of "Random farm tests" where rec ords of egg production are kept by the farmer and mailed each week to an official agency where they are tabulated Such a test, if con ducted on an extensive scale, could give much valuable information if the stocks being tested were accurately *identified as to strain* This information is frequently difficult to ascertain, as there are surprisingly few hatcheries or supply sources well enough informed on the back ground of the stock they offer to give anything like accurate informa tion However, the fact that this type of test does give the ultimate information sought that is how well a stock performs under average farm conditions, merits its further consideration and development

Standard Egg Laying Tests

Standard egg laying tests have been for many years a source of in formation on the laying abilities of stock from various breeders Of the value of winnings in standard egg laying contests, Jull (1953) states

> I am of the opinion that too much emphasis should not be given to a breeder winning a single contest but if the same breeder wins or ranks very high in three or four or even more tests it is a much better index of the breeding value of his stock than merely winning one contest

Lerner (1951) says

> exceptionally high records at laying tests are of little value to the commer cial producer unless he is certain that the stock he buys has been produced by the same methods producing the contest winners The birds in laying test pens may, for instance represent crosses between two strains and ex

Table 16–1 A comparison of performance factors by breeds for entries in the California Standard and Random Sample Laying Tests

(Johnson 1953)

Breeds	1949–1950 10th Standard Test	1949–1950 1st Random Test	1950–1951 11th Standard Test	1950–1951 2nd Random Test	1951–1952 12th Standard Test	1951–1952 3rd Random Test
	Original Number of Hens Entered					
White Leghorns	468	1045	416	1000	312	1182
Barred Plymouth Rocks	26		26		26	
White Plymouth Rocks						45
White Wyandottes	26	57	26		26	
New Hampshires	78	179	52	298	26	109
Rhode Island Reds	130	325	104	267	26	188
California Grays					26	
Australorps	26		52			
Crosses	130	458	156	504	78	
Light Crosses						426
Heavy Crosses						55
Test Flock	884	2064	832	2069	520	2005
	Per Cent Mortality					
	%	%	%	%	%	%
White Leghorns	10.7	34.0	11.1	13.7	10.6	13.0
Barred Plymouth Rocks	7.7		11.5		0.0	
White Plymouth Rocks						15.6
White Wyandottes	0.0	26.3	0.0		15.4	
New Hampshires	5.1	21.8	9.6	29.9	7.7	17.4
Rhode Island Reds	11.5	29.9	14.4	22.9	26.9	13.8
California Grays					34.6	
Australorps	7.7		23.1			
Crosses	18.5	39.1	16.0	17.7	25.6	
Light Crosses						14.3
Heavy Crosses						7.3
Test Flock	11.0	33.2	12.7	18.2	14.4	13.5
	Average Number of Eggs per Hen *					
White Leghorns	243.5	191.2	235.9	229.3	234.9	237.1
Barred Plymouth Rocks	264.5		261.6		264.2	
White Plymouth Rocks						152.0
White Wyandottes	247.6	177.5	243.5		217.5	
New Hampshires	215.5	180.5	206.3	170.4	228.1	176.5
Rhode Island Reds	235.3	194.3	223.1	200.8	222.7	213.1
California Grays					169.9	
Australorps	219.4		182.4			
Crosses	219.6	184.2	224.2	223.2	222.0	
Light Crosses						235.3
Heavy Crosses						191.9
Test Flock	236.3	188.7	227.9	215.4	229.4	228.2
	Net Income per Hen †					
	$	$	$	$	$	$
White Leghorns	4.40	3.08	6.84	6.41	5.22	5.5[illegible]
Barred Plymouth Rocks	4.35		7.39		5.88	
White Plymouth Rocks						2.79
White Wyandottes	4.19	2.16	6.81		3.61	
New Hampshires	3.01	3.13	5.15	4.07	4.30	3.40
Rhode Island Reds	3.35	3.48	5.86	5.3[illegible]	3.90	4.64
California Grays					3.15	
Australorps	3.76		4.72			
Crosses	3.58	2.93	6.13	6.28	4.28	
Light Crosses						5.43
Heavy Crosses						4.22
Test Flock	3.98	3.09	6.36	[illegible].62	4.82	5.23

* Computed on the basis of the original number of birds entered

† Computed on the basis of the original number of birds entered, includes gain or loss in meat value

find a certain number of poor laying birds, a larger number of medium laying birds, and a small per cent of exceptionally good birds The curve we would obtain if we plotted all of these birds according to egg production or any other similar character is referred to as a normal curve

Pullets selected by the breeder to make up his contest entries in our Standard egg laying tests are selected as far as possible from the upper end of this curve It is true that our methods of selection on a limited amount of pretrapping will not permit 100 per cent accuracy in selection but, as far as possible, that is what we do Such a sample is far above that of a Random sample because of the selection pressure applied by the breeder

However, despite the fact that Random sample tests represent "un culled averages," some entries in present day tests are making remark ably high averages For example, in the Fourth California Random Sample Egg Laying Test (1952–1953) the high entry produced 260 eggs per pullet, another entry produced 251 eggs per bird, and another 249 Table 16–1, compiled by Johnson (1953), shows the results of the California Standard and Random tests for a 3-year period These results show that sometimes the birds in the Random sample tests laid more eggs and had a higher net income record than entries in the Standard laying test Both the California tests are under the same general management and provide nearly identical conditions of feed ing and housing

The Sixth California Random Sample Egg Laying Test is scheduled for March 4 1954 to September 30, 1955 Some of the features of this test include

1 An entry shall consist of two lots of 40 pullets each Each lot must be selected from a total of at least 500 pullet chicks but must be selected from the entire hatch of the grade and breed or cross designated by the entrant available on the dates on which the selection is made This grade will be specified in all published reports of the test The selection will be made by a person officially designated to represent the commission The chicks must be placed in new boxes, which are to be sealed by the selecting agent for delivery to the project with seals intact.

2 The first lot of chicks must arrive in Modesto on Tuesday, Wednes day, or Thursday, March 2 3 or 4 The second lot must arrive on Tuesday, Wednesday, or Thursday, March 30 31, or April 1

3 Chicks of each entry will be identified by toe marks on arrival.

4 Each entry will be brooded separately at the project in a manner to provide uniform environment. Each lot of each entry will be randomly located in relation to other entries

5 At 1 week of age each lot will be reduced to not more than 35 chicks The number of pullets in competition will be the total in the entry at 1 week of age less cockerels which may show up owing to errors in sexing and very obvious accidental deaths

1 Select only vigorous, active, and healthy chicks

2 Perfection and development The navel should be perfectly healed No pasty vents should be present The down should be fluffy, dry, and show no signs of stickiness Discard all those with crooked toes and other deformities

3 Uniformity of size Chicks varying in size from the average weight may be penalized Chicks should be hatched from eggs weighing at least 2 ounces

4 Apparent breed type The American Standard of Perfection lists the standard color of most breeds

5 Trueness of color All chicks should be representative of their breed Compare the shank color with the average of the entry

6 Uniformity of color It would be desirable to examine about twice the number of chicks for an entry and then select an entry with uniform color

Scorecard for Chicks and Poults

	Perfect Score
Sturdiness and activity (vigor)	25
Perfection of development (condition)	25
Weight before feeding	10
Uniformity of size	10
Trueness of color	15
Uniformity of color	15
Total	100

Egg Shows

Some hatcheries participate regularly in egg shows Such participation indicates the hatcheryman's ability to select a quality product, and a winning may be helpful in advertising An egg show scorecard is shown in Table 16–2

Suggestions to egg show exhibitors on points of selection are as follows

1 Uniform weight size, and shape Have each egg in the dozen as nearly alike in weight as possible Total weight of the dozen should be between 24 and 27 ounces Size and shape should be carefully observed for uniformity

2 Uniform color Each egg in an entry should be as nearly alike in color as possible Eggs should be graded for color under daylight conditions Avoid variations in shade of brown eggs or tints in white eggs as much as possible

6 The test will end on September 30, 1955

7 *The pullets will not be trapnested, only pen records will be kept for each entry*

8 A record of all income from each entry will be kept separately and credited to it This will include income from eggs laid during the period of the test and the income from the hens slaughtered at the end of the test All eggs and poultry meat will be graded on a market quality basis Hens rejected for market will be given no credit and will be charged as mortality and autopsied

9 Cost of total feed consumed for the test period will be charged to each entry

10 The final standing of the entry will be determined by the average pullet net income based on the number of pullets at 1 week of age

Official Poultry Improvement Program Records

State and National Poultry Improvement Plan programs set up certain minimum standards of quality which are helpful to hatcheryman and chick buyer alike in choosing a source of chicks

For the hatcheryman, information on the supplier's pullorum control program and on the egg production breeding back of his stock are a matter of record and can be easily checked with the state supervisory agency for accuracy The hatcheryman may also wish to bring in new stock for improvement of his flocks For this purpose, he can refer to the published U S Record of Performance summaries Breeders with large flocks, with consistent, year after year high production averages, with the desired body weight and egg weight can usually be depended on for desirable stock

The chick buyer can adopt much the same measures for selecting a reliable chick source, by checking with the state agency or by questioning the supplier about his breeding improvement and pullorum control program A breeder or hatchery with a year after year record and reputation for supplying good quality chicks or breeding stock is usually a safe choice as a source of supply

Chick Shows

Chick shows stimulate interest in selecting chicks for quality appearances, and thereby serve a useful purpose The time of hatch in relation to the time of showing is an important factor in getting a good choice of chicks Chicks hatched too far in advance of show time may become so dehydrated that they are light in weight, and rough and dry in appearance Chicks hatched too late may not show the maximum of bright, alert activity necessary for a winning entry The following are some pointers on selecting chicks for showing

60°) and moisture before sending them to the show If eggs are candled, observe the following points

(*a*) Sound shelled eggs The shell condition can be seen only by candling Eggs selected should be sound and "finely pored" free from fine checks or large thin areas

(*b*) Small air cell A small air cell (less than ⅛ inch in depth) is an indication of good handling of the egg under desirable temperatures and moist surroundings, which prevent evaporation

(*c*) Dimly visible yolk The outline of the yolk should be only dimly visible, and not rapid moving No germ development should have occurred and eggs (if fertile) should be gathered frequently and kept at temperatures below 60°

(*d*) Firm, clear white The white should be clear and firm as indicated by a yolk which moves slowly when egg is candled No foreign objects should be present in the white, such as meat spots

Showing Meat Type Poultry

With the advent of the Chicken of Tomorrow contests, there has developed a rather widespread interest in showing meat type birds These shows also stimulate interest in meat quality factors and thus encourage the breeding of better meat type stock

Parnell (1953) said

> market poultry shows are setting a goal for producers to shoot at" To win in such shows, producers need to
>
> 1 Start with a good meat type chicken preferably with white or light plumage
> 2 Full feed the birds throughout on a high quality ration
> 3 Keep the flock free of disease at all times
> 4 Select show birds carefully, and dress them properly

Breeding for meat type excellence requires the same careful system of breeding and progeny test records as required for egg production breeding Figure 16–1 shows the pedigreeing of meat type chicks Of this system, Walling (1952) writes

> this shows our pedigree wheel in operation, which is used when wing banding the pedigree chicks The wheel revolves in clockwise fashion Chicks are placed on top of the boxes on the wheel and the pen and hen numbers are called out to a girl who places the proper bands on the lip of the wagon box As the wheel revolves the women doing the piercing of the wings remove the chicks and after the wings are pierced and the bands inserted the men to their left clinch the bands on the wing and the chicks are then placed in ordinary chick boxes The use of the wheel

Table 16-2 Egg show scorecard used in Midwest Egg Chick, and Poult Show, Ames Iowa

Scorecard

Exhibit No ________ Color________

Class________

Score________

		Perfect	Actual
Weight________		22	
Exterior Appearance		30	
A Uniformity of Size	6		
B Uniformity of Shape	6		
C Uniformity of Color	9		
D Cleanliness and Texture	9		
Interior Appearance		48	
A Shell Soundness	6		
B Air Cell	6		
C Yolk	18		
D White	18		
Total		100	

Name________ Town________

3 Clean shells and good shell texture Eggs should be clean and must show no evidence of having been cleaned

Eggs showing rough areas wrinkles, ridges and other evidences of irregular shell texture should not be selected

Note It may not be possible always to examine for interior egg quality of the egg before the candler In that event, aim to have the best exterior quality and select the freshest eggs available for exhibiting Keep these eggs under desirable holding temperatures (45 to

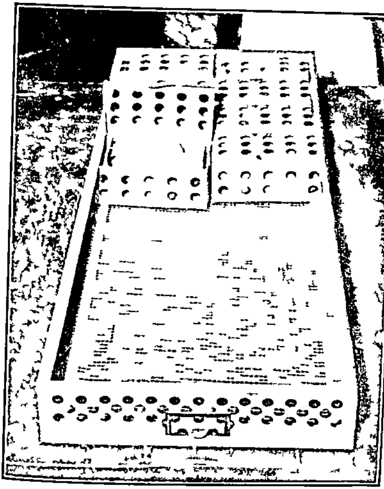

Fig 16–2 Chicks in paper or cardboard pedigree baskets (Courtesy Nichols Poultry Farm Kingston N H)

designated by the entrant available on the date on which the selection is made

2 The chicks will be sexed at hatching time and 50 pullets and 50 cockerels will constitute an entry Sexes will be brooded separately

3 Each entry will be slaughtered dressed and eviscerated at the end of the test They will be graded according to U S D A standards for eviscerated poultry The price credited to entries shall be that paid for the respective class and grade prevailing at the end of the test Reject birds will be given no credit and will be charged as mortality and autopsied

4 The following costs will be charged to each entry total feed consumed price of chick F O B entrant s hatchery and extra dressing costs for removal of excess pin feathers

5 The final standing of the entries will be determined by the difference between total income and total cost adjusted to a 50 50 sex ratio and based on 100 chicks

FIG 16–1 Pedigree hatching chicks (Courtesy Nichols Poultry Farm, Kingston, N H)

enables three crews of banders to work at the same time and reduces to a great extent the fatigue ordinarily associated with this operation

Another technique of interest in pedigree hatching of meat type chicks is shown in Fig 16–2 Of this Walling says

> this shows one of our pedigree hatching trays with the type of pedigree basket used last year, made of disposable cardboard We have changed this system this year and are using aluminum baskets which are inverted over the eggs and are identified by diamond shaped pieces of cardboard on which the hen and pen numbers can be recorded When the hatch is taken off, these cardboards can be pulled from the inverted baskets and thrown away

Random Sample Meat Tests

Actual performance tests which give averages on an unculled basis of growth rates, feed efficiency, eviscerated weight, and carcass quality are of the greatest importance in determining a source of supply for meat type stock.

Some of the features of the California Random Sample Meat Production Test include.

1 An entry shall consist of 180 hatching eggs which will be taken at random from the entire number of eggs of the grade and breed and cross

17

Prevention and Control of Disease in the Hatchery

A hatchery must produce healthy chicks This is a simple statement of fact, yet one that may be difficult to accomplish One of the wishes frequently expressed by hatchery managers is that they had more training in disease diagnosis and control The diagnosis of disease is a highly technical phase of the poultry business and if possible should be left to persons specially trained and equipped for this work However, the hatcheryman will frequently find a general knowledge of diseases helpful in solving problems that often arise A knowledge of sanitation and disease control measures may be the means of preventing serious trouble in the hatchery and of saving thousands of dollars and customer good will

Hatching healthy chicks requires hatching them from eggs produced by healthy parent stock and taking proper precautions in the hatchery to prevent entry of disease producing organisms from outside sources

GENERAL METHODS

Hatchery Location and Disease Prevention

From a disease control standpoint, the hatchery should not be located near live poultry and egg buying stations poultry processing plants broiler plants, started chick plants or other hatcheries It is dangerous from a disease standpoint to attempt to produce and handle day old chicks in proximity to adult live poultry Beginning with started chicks the danger of spread of infection appears to become greater the older the birds with which the chicks are brought in contact

The brooding of started chicks in the hatchery building can be very hazardous to the hatchery operation Started chicks may contract chick bronchitis "coryza," Newcastle, or one of several respiratory diseases If they are brooded in the hatchery, this infection can spread

RESPONSIBILITY OF THE HATCHERYMAN

The hatcheryman has the responsibility of producing a chick that represents a fair value to the customer. He also has the responsibility of accurately describing his product so that the customer can determine whether the chicks he buys will actually fulfill his requirements. For the commercial producer with laying hens or broiler chicks it is essential that he ask for and receive from the hatcheryman accurate information on chick quality; his livelihood depends on the accuracy of his information and his evaluation of it.

Chick quality has improved tremendously over the years, and yet the cost of chicks has remained essentially the same for many of those same years. It costs money to carry on a program of flock improvement essential to producing a profitable quality chick. Improving quality without increasing prices is undoubtedly a tribute to our competitive system of free enterprise. It may also mean that hatcherymen should reconsider their pricing in view of present day costs.

been handling adult live poultry in culling and bloodtesting, they should wash and clean thoroughly and change clothing if they are required to ship baby chicks. If this precaution is not taken, a very

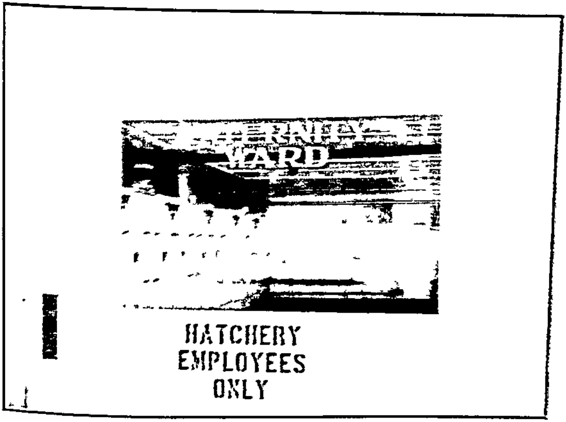

FIG. 17-1 The entrance to the separate incubator room is guarded with a "Hatchery Employees Only" sign, with the explanation that this is the "Maternity Ward." (Courtesy Cobb's Pedigreed Chicks, Concord, Mass.)

"hot" infection may be transferred to the chicks being shipped and the entire shipment may be lost and require a replacement or adjustment.

Preparing the Hatchery for Operation

Each year before the season of heavy production gets under way, the hatchery building and all equipment should be thoroughly cleaned and fumigated. A hatchery that operates a year-round business may shift production among different machines so as to permit thorough cleaning of all incubators. All movable interior fixtures should be removed from the incubators and hatchers. The interiors of the incubators should be thoroughly cleaned, disinfected, fumigated, and painted. This will not only destroy any disease-producing organisms present but will also preserve the wood or metal used in the construction of the machines.

to the incubators so that every chick hatched will "catch" the infection within a short time after hatching, whether brooded in the hatchery or on a customer's farm It is safer, therefore, to locate brooders in a building separated from the hatchery building, with separate entrances and separate ventilation and air exchange If possible, the started chick plant should have sufficient volume so that personnel caring for the chicks do not find it necessary to go into the hatchery

Chicken coops should not be brought in or stored in the incubator room or near chick boxes, pads, or egg cases Neither should live adult chickens, turkeys, or broilers be brought into the hatchery Occasionally, customers may wish to have the hatcheryman make a postmortem examination of chicks or grown chickens to determine the cause of sickness The hatcheryman may perform this work if he desires, but he should recognize the dangers and risks involved and take all necessary precautions to wash thoroughly and to change clothing after such examinations Under no circumstances should live chickens be brought into the hatchery, and the hatcheryman should be doubly alert to prevent visibly sick chickens from being brought in

The Incubator Room

It is desirable that incubators be located in a separate room with a "No Admittance" sign at the door, as shown in Fig 17–1 Visitors and even prospective customers should be kept out of brooder rooms as a disease prevention measure People may unknowingly carry disease organisms on their clothing or shoes Prospective customers may be "shopping" for chicks and in going from one hatchery brooder room to another may carry infection from one group of chicks to another

As far as possible, all supplies likely to gather dust should be stored outside the incubator room Air borne disease producing organisms may be carried on dust particles Therefore, disease control measures should include practices that keep down dust in the hatchery as far as possible

Used egg cases from produce houses may be sources of contamination Flock owners should start the new hatching season with new egg cases, with new clean fillers and flats These cases should be properly marked to assure that they are brought into the hatchery each week when eggs are delivered Even new egg case material may be a source of infection to chicks if it has been stored in a feeding station or around a produce house where dust from live poultry settles on it

Often, the persons doing flock work for the hatchery may be required to ship baby chicks on the same day If culling crews have

Some Facts about the Spread of Pullorum Disease in Incubators

Chicks hatched from non infected hens may become infected with pullorum disease Such chicks generally show lung infection

Chicks hatched from pullorum infected eggs are heavily contaminated with pullorum, and their down when it dries becomes a carrier of the disease producing bacteria Unless a well organized fumigation program is followed, this infected down is carried throughout the incubator by air movement and may infect many healthy chicks

Formaldehyde gas may be used which is strong enough to kill *S pullorum*, without injuring the chicks that are in the incubator This fact makes possible fumigation to minimize the spread of pullorum disease from infected to non infected chicks hatching at the same time in the same incubator

It should be recognized that fumigation has its limitations, and it should be used only to do the job it can do, namely, to prevent the spread of pullorum at hatching time and to reach organisms in otherwise inaccessible parts of the machines

Fumigation cannot destroy the organisms in the egg or in the chick It is not a substitute for a testing program for the elimination of reactor hens instead it is a part of a well planned pullorum control program for the modern hatchery

Evidences of Improper Fumigation

Fumigation unless properly done, may be of no value or actually harmful If the concentration of gas is too weak, the pullorum organisms will not be destroyed If overdoses are used the hatchability of eggs in the incubator may be greatly reduced, especially in the eggs set 48–96 hours before the fumigation Too strong fumigation results in chirping" chicks and a noticeably yellow down on white chicks

General Instructions on Fumigating Incubators

Dr Robert Graham University of Illinois (1950), wrote

> Fumigating eggs and newly hatched chicks in forced draft incubators at hatching time is recommended as further protection against the spread of pullorum omphalitis and Newcastle disease It destroys these germs on eggs and chicks The best chemical known for fumigating incubators is formaldehyde It is a gas that is sold as formalin Formalin is a 40 per cent solution of formaldehyde in water
>
> There are two ways of using formaldehyde the cheesecloth method and the potassium permanganate method Directions are given below You will probably get best results with the method you can use most accurately

Fixtures should be cleaned and then soaked in a lye water solution or other equally strong disinfectant Metal parts of fixtures should also be painted with aluminum paint The exterior of incubators constructed of wood or composition materials should be varnished or shellacked

During this thorough clean up, all fixtures should be checked and any that are not in good working order should be replaced or repaired If location permits, and production can be stopped, after the hatchery and all equipment have been cleaned a triple strength fumigation of the entire hatchery will provide a sanitary hatchery for starting a new chick season For best results the temperature and humidity should both be as high as it is practical to make them

Dipping Hatching Eggs

Some hatcheries dip all eggs in a disinfecting solution before setting with the objective of destroying any disease producing organisms which may be on the shell The labor and trouble of such disinfection with its questionable benefits, have discouraged this practice Fumigation of the eggs after they are set appears to be a more practical method of destroying disease producing organisms on the eggs

Controlling the Spread of Disease within the Incubator

Pullorum disease and mushy chick disease, and possibly other egg borne diseases may be spread in the incubator at hatching time Precautions should be taken in all hatcheries to prevent or at least minimize the spread of such diseases from infected to healthy chicks in the incubators The organisms causing these diseases may be carried by the chick down that is found floating in the air after the chicks have "dried off" If none of these organisms is present, the hatcheryman has no problem but he cannot afford to take a chance with such disease hazards By maintaining high humidity (a wet bulb reading of 90°F or higher) at hatching time the amount of floating down is reduced and thereby the spread of pullorum disease is minimized

Cleanliness where the chicks are hatched is most important All down, shell particles etc , should be removed A vacuum cleaner is an indispensable aid in thoroughly cleaning the incubator where chicks are hatched The use of crinoline or paper on the hatching trays in incubators that recommend such materials aids in maintaining more sanitary conditions All waste should be removed from the hatchery premises in the most practical and sanitary manner

3 Put potassium-permanganate crystals in an enamel pan big enough to hold about 10 times as much solution as you will use (Do not use glass or earthenware pans, the chemical combination produces heat that may break them)

4 Set pan in central compartment of incubator under the fan If you have large incubators, you may want to use more than one pan (In some forced draft incubators, the crystals may be put in a broad shallow pan set in a cabinet under the intake pipe If you put your pan here, be sure to leave damper in pipe wide open so that gas can pass freely into incubator)

5 Pour formalin over the potassium permanganate crystals and close incubator door quickly Formaldehyde gas is immediately released

6 Do not open incubator for 3 hours Then take chicks out and put them in clean, new boxes or in clean brooders

Fumigation and Chick Health

Healthy chicks do not seem to be affected by fumigation when it is done at the time they are hatched Weak chicks are sometimes injured, but injury to them is not important compared with the good that fumigation does in preventing the spread of disease Fumigation will not, however, destroy disease germs inside a chick, and it won't cure a chick that has a disease

Caution Do not try to fumigate chicks that are more than 48 hours old

Stronger Fumigations Sometimes Needed

Under some conditions double and triple strength fumigations are desirable Triple-strength solutions used before the hatching season starts and between each hatch are needed for protection against both pullorum disease and Newcastle disease

Eggs will not be injured by repeated fumigations with double or triple amounts of formalin after the first 96 hours of incubation Do not, however, expose chicks to these amounts After the chicks are hatched, use only single strength solutions

Joseph Taggart makes the following recommendations on fumigation·

The strength of fumigation that we can safely use in the incubator while chicks are present is not sufficient to kill some of the offending organisms, for example, those that produce omphalitis or navel infection To reach these organisms, we must fumigate at 2½ times the regular strength, and such fumigation can only be done when there are no chicks in the machine Even then, you should not allow the gas at this high concentration to remain in the machine longer than 15 minutes Some operators do, but occasionally, for no apparent reason, they damage eggs in the early stages of incubation It is for this reason that we caution you to air out the incubator 15 minutes after the gas is released Remember that this damage is not always present, but it has been observed in all types of incubators If the damage is slight, you find a few sticky chicks and more culls than usual In more severe cases, the above symptoms are increased, and in some cases

(Most manufacturers give detailed directions for fumigating their incubators By following their directions you will probably be saved the trouble of calculating the number of cubic feet of air space in your incubator and figuring the amount of formalin to use)

The cheesecloth method has some advantages—it takes about 60 per cent less formalin than the potassium permanganate method and it requires only two fumigations whereas the potassium permanganate method takes three On the other hand the potassium permanganate method causes the operator less discomfort than the cheesecloth method

Cheesecloth Method

To fumigate by this method will take (1) formalin (2) a measuring cylinder (3) clean cheesecloth and (4) wire hooks or a small glass rod on which to hang the cheesecloth

You will need to fumigate twice during hatching first when 10 to 20 per cent of the chicks are out of the eggs then 12 to 15 hours later When ready to fumigate see that the relative humidity of the air is about 68 per cent (this means a wet bulb reading of 90°F when the dry bulb reading is 100°F) The right humidity cuts down the circulation of dust and down, favors hatching and helps the formaldehyde do its work To fumigate by this method you do these things

1 Figure number of cubic feet of air space in incubator (length × width × height)

2 Measure out ½ ounce of formalin for every 100 cubic feet of incubator space

3 Dip the cheesecloth in the formalin Use enough cloth (It must take up all the liquid and yet not drip) Cut off what you don t use If you like use several smaller cloths instead of one large one

4 Hang the wet cloth on the wire hooks or the glass rod near the incubator fans shut the door and turn on the fans

5 Let formalin soaked cloth stay in incubator for at least 3 hours Then take out all the dry chicks

Caution While hatching chicks are being fumigated keep ventilating fans running Don t use old solutions of formalin that have stood exposed to the air

Potassium Permanganate Method

To fumigate by this method will take (1) potassium permanganate crystals (2) formalin (3) a measuring cylinder and (4) a deep enamel pan Have humidity at about 68 per cent (a wet bulb reading of 90°F when the dry bulb reading is 100°F)

Time 3 fumigations 13 hours apart making the first soon after the first chicks leave the eggs

These are the steps in fumigating with potassium permanganate

1 Figure number of cubic feet of air space in incubator (length × width × height)

2 For each 100 cubic feet of air space use 1 ounce of formalin and ¼ ounce of potassium permanganate crystals

When 5 to 10 per cent of the chicks are out of the shell, raise the humidity from 85°F wet bulb to 90°F and fumigate at normal strength. We have instructed you that the next fumigation should take place about 12 hours later. However, it is desirable to so schedule your work that this second fumigation takes place immediately after fresh eggs are set. In this way, the fresh eggs and the wet chicks are taken care of in one fumigation. The last fumigation of the cycle should take place after the machine has been cleaned. Thirty minutes after that fumigation, the moisture should be returned to the 85°F wet bulb reading.

Quantities of Chemicals to Use in Fumigation

The amount of 40 per cent formalin and potassium permanganate to use depends upon the method used to liberate the formaldehyde gas and the organisms under control. When potassium permanganate is used with formalin, for each 100 cu. ft. of incubator space, 35 cc. (1.2 oz.) of 40 per cent formalin are poured over 17.5 grams (0.6 oz.) of potassium permanganate in a relatively large enameled container. If the cheesecloth method is used sufficient cheesecloth is used to absorb 20 cc. (0.7 oz.) of formalin per 100 cu. ft. of incubator space to be fumigated.

Industry-Wide Sanitation Programs

State poultry improvement associations and the National Poultry Improvement Plan attempt to improve hatchery sanitation conditions. The following resolution is an effort toward improving the control of poultry diseases by a state-wide hatchery sanitation program.

MISSOURI HATCHERY SANITATION PROGRAM

Be it resolved that the Missouri Poultry Improvement Association at its annual meeting in Columbia, Missouri, on August 4, 1947, do hereby adopt the following additional rules and regulations governing all of its members and to be enforced in the same manner as the other rules and regulations governing the membership under the National Poultry Improvement Plan and under the laws and regulations of the Association are enforced. That the enforcement of these rules shall be in cooperation with the State Department of Agriculture and the State Veterinarian and shall be as follows:

1. All flock testing groups in the field going from one farm to another shall thoroughly clean and disinfect their hands, shoes, testing equipment, crates and wearing apparel. Said disinfection shall be one of the following manner. [Said disinfection shall employ a disinfectant and technique as recommended by the Bureau of Animal Industry (U.S.D.A.).]

(a) A liberal supply of a permitted disinfectant.

(b) One or more stiff bristled brushes. Generally, brushes such as are used for cleaning milk cans will be found satisfactory.

(c) One or more heavy metal buckets.

(d) Each person performing service work on poultry premises should wear outer footwear (overshoes or boots) of rubber, or other impervious

the hatch has been a total loss Many operators compare the appearance of the chicks with those that come from eggs that have been mistreated or held too long Eggs are most easily damaged during the first few days in the incubators, and we are apt to forget just how the fumigation was handled two to three weeks back

In one case, a small incubator containing eggs in 6 stages of incubation, 3 to 19 days, was fumigated at triple strength and not aired out for 6 hours The oldest eggs which hatched two days later were off about 5 per cent in hatch and there were several sticky chicks Each of the succeeding hatches showed an increasing amount of damage The eggs that were 3 days old at fumigation hatched 20 per cent, and none of these chicks were salable

Fumigation to prevent the spread of pullorum organisms from chicks that are hatched with the disease to other chicks in the incubator can only be carried out when the chicks are hatching and cannot be of the same concentration as when fumigating for navel infection This milder form does not damage the eggs It can be severe enough to affect the respiratory tract of the chicks and, in most cases, this is the result of not airing out the machine quick enough

To sum up when fumigating between hatches, you can safely use either method and increase the quantities to 2½ times those recommended for fumigating chicks Be sure to have the wet bulb thermometer 90°F when the gas is released and then air out the incubator after 15 minutes of the strong concentration This fumigation should be a part of the clean up following the hatch Do it as soon afterwards as practical in your hatchery but before the newest eggs have been in the incubator 48 hours Recent checks show that this strong concentration will kill Newcastle on the outside of the eggs These recommendations are made specifically for Chick Master incubators but will apply to Smith incubators of the corresponding models In addition to the "whys" and "hows" of fumigation, it is equally important to know when to fumigate The correct time cannot be set by the calendar or by the clock The rules of incubation are not made by man They are nature's laws and she has a way of changing them slightly from time to time

Study the condition in the incubator if you wish to obtain the maximum benefits from fumigation For example, when you set cool eggs in a Chick Master in regular operation, chicks will be hatching and the wet bulb reading will be 90° The moment these cool eggs enter the loading door, moisture will cover them just like it does your glasses Due to the volume and temperature of the eggs, they will be sweating for ½ hour or more If you fumigate the eggs at that time, the moisture surrounding the egg will absorb enough gas to make a weak solution of liquid formaldehyde covering the shell As the eggs dry, this solution becomes more concentrated and in this way tends to sterilize the surface of the egg To obtain full benefit of this, we recommend that, when starting an empty machine, you raise the humidity to 90° just before you set fresh eggs After the eggs are set fumigate at normal strength and maintain the high humidity for approximately 30 hours Then drop the wet bulb reading to 85°F Follow this process at each setting When chicks begin to hatch on the twenty first day, the following fumigation procedure should be followed

no event start such chicks or keep them in the room in which is situated the incubator

10 No member shall purchase or handle any eggs from any flocks in which said member has reason to believe that there is any infection in said flock which might be diagnosed as Newcastle disease, and the flock owner shall be advised by the member of the contagious nature and danger in said disease and induced if possible to place said flock under voluntary quarantine pending full investigation and diagnosis by a laboratory approved by the State Department of Agriculture, and a report of the findings shall be promptly submitted to the State Veterinarian and a copy sent to the Secretary of the Association

11 All hatchery wastes and offal shall be kept in covered containers and removed from the premises after each hatch, and the containers used to remove such materials should be cleaned and disinfected after each use

12 Hatchery premises and equipment must be kept free of all contaminating influences and in a clean and sanitary manner at all times

13 Hatching egg cases, fillers and flats should be kept in clean and sanitary condition

14 No used chick shipping boxes or new boxes which have been stored in any room containing started chicks feed bags, used egg cases poultry crates, or any live poultry, sick or well, shall be taken into the incubator room

CONTROL OF CHICK BRONCHITIS

In years when chicks are surplus and hatcheries are forced to put too many chicks in battery brooders, particularly early in the season, trouble frequently occurs in the form of chick bronchitis If allowed to continue without control measures, this disease can ruin in a few weeks the reputation for quality that a hatcheryman has taken years to build up Some hatcherymen attempt to "cure" the affected chicks with sprays and various medicines Such measures are practically always a waste of time This disease can have a very drastic effect and, therefore, requires drastic measures to combat it

The first step in the control of chick bronchitis is to completely depopulate the brooder and hatchery of all live chicks The hatchery, brooders, and all equipment must be thoroughly cleaned, the walls and floors washed, all dust removed from tops of incubators and everything given a good cleaning Preparatory to fumigation with formaldehyde, the temperature in the room should be raised to 90°F, or at least in the 80s, the room, walls, and floors should be thoroughly wet down, and the room made ready for fumigation

If the incubator room is being fumigated, the formaldehyde gas should not be left in the room more than 20 minutes, as longer exposure may kill the developing 1- to 3 day old embryos Fumigation with 40 per cent formalin and potassium permanganate is recommended

material which can be readily cleaned and disinfected Each such person should be equipped also with outer clothing such as aprons coveralls, long coats or bibbed overalls and jackets made of rubber or rubberized material or pervious fabric If the clothing is of the latter type each person should have a supply sufficient to provide a freshly laundered garment on each premises If the apparel is of the water repellent material one garment will suffice for each person since it may be cleaned and disinfected readily and as frequently as required

(e) A substantial stirrup pump or bucket spray pump with attachments for use in pressure spraying of equipment too large for immersion in the available containers of the disinfectant solution

(f) A supply of soap and clean towels (either fabric or paper)

2 No member of this Association shall conduct the business of starting chicks within the hatchery room in which are contained the incubators and no chicks shall be kept in said room in which are contained incubators for a longer period than the customary period preceding shipment of baby chicks The starting of chicks shall be conducted in an entirely separate room isolated from the incubator room

3 Members who are conducting the business of starting chicks as well as hatching *chicks or shipping hatching eggs shall not permit employees to* go from the room in which chicks are being started and eggs received into the incubator room and working with the incubators eggs or baby chicks without first taking the necessary precaution of disinfection as provided for the testing crews above in rule 1

4 No member of this Association shall store feeds store return feed bags or store used supplies or used egg crates in the room in which the incubators of said member are situated and all of the above articles if within the same building shall be received or stored in a separate enclosed room separated from the room in which the incubation of chicks is in progress

5 All employees of the member engaged in handling feeds live poultry receiving eggs or handling return feed bags who also work in the incubators and with the baby chicks shall take the precaution of disinfection as provided in rule 1 for testing crews

6 No member shall in any event permit growing or adult birds at any time for any reason in the room in which the incubators of said members are situated

7 No member shall post sick or dead birds in the hatchery building and any member or employees making an inspection of sick flocks and posting of birds shall take the necessary precaution of disinfection as provided for testing crews in rule 1 above

8 The shipment of diseased birds to laboratories for diagnosis is a dangerous practice and is condemned since said shipments are frequently carried in the same car transporting live chicks or eggs and the danger of infection is greatly increased and until such time as a satisfactory method of transmitting diseased or dead birds to laboratories can be perfected which will eliminate any possibility of contagion this practice must be stopped Samples of blood for diagnosis may be shipped

9 Members engaged in the practice of started pedigreed or R O P birds purchased by them as chicks and for distribution to flock owners shall in

Infected navels are partially within our control in that they are influenced by plant management Chicks should be hatched right, so that a maximum number of navels will be healed at the time they are taken off If they are too green, chicks should not be handled any more than is necessary, and sexing at this stage should be avoided Rough handling should never be practiced and especially at this time Do not throw chicks about on reused excelsior pads or pads that have been allowed to become moist and moldy. In these and similar ways, the navels become infected after the chicks are taken from the incubator If the infection starts several hours before grading, you will usually cull them out at that time because of visible infection or sluggish appearance If the infection just occurred, you may grade them as good chicks but have death losses one to two days later under the brooder.

When there is no pullorum or omphalitis present, pathologists find that most chicks which die during the first 48 hours die from an infected navel One investigator who has kept records on hundreds of lots of chicks finds that the majority loses 1 per cent, or better, from this cause If the infection started 24 hours before the chicks go over the grading table, you will cull out most of them at that time When the chicks are graded too green, you can expect losses under the brooder Theoretically, it is possible to have no losses from this source, but in practice they occur, and we should endeavor to hold them to a working tolerance

The above discussion makes a distinction between omphalitis or navel infection and the occasional chick loss owing to an infected navel In true omphalitis, the infection may be widespread and losses heavy, whereas in cases of infected navel, losses may be relatively light, around 1 per cent as suggested above.

Newcastle Disease

Hitchner (1951) states

Newcastle disease is a respiratory and nervous disorder of poultry which affects many species and all ages Both the respiratory and nervous symptoms of Newcastle disease may be confused with other diseases producing similar symptoms If a respiratory outbreak occurs followed by nervous symptoms this is quite indicative of Newcastle disease However, it is possible for flocks to have the disease and exhibit only one or the other of these symptoms, in these instances an accurate diagnosis frequently requires the aid of laboratory tests

In the United States we have relied primarily on vaccination of poultry to control Newcastle disease There are three principal types of vaccines on the market There are certain advantages and disadvantages to each, and the poultryman should realize none of the present vaccines give perfect protection

The killed virus vaccines were the first to be used Their advantage is that they cannot produce the disease, which permits their use where the live-virus vaccines are prohibited (that is, areas where laws limit the use of live virus and in chicks destined for shipment through the mails).

for rooms using 1 pint of formalin and ½ pound of potassium permanganate per 1 000 cubic feet

The room should be closed tightly for 20 minutes during fumigation Fans should be operated in the room to distribute the gas during fumigation and to eliminate it after 20 minutes of fumigation

After the hatchery has been thoroughly fumigated, caution should be exercised to see that infection is not reintroduced into the hatchery by infected chicks which may be brought back in or by clothing which may not have been laundered Clean clothing and shoes should be worn by all hatchery personnel to prevent reintroduction of the disease into the hatchery or brooder

OTHER HATCHERY DISEASE PROBLEMS

Omphalitis

Graham (1951) states

> Omphalitis or "mushy chick disease" is a disease peculiar to incubator hatched baby chicks An acute form of this disease is observable at the time the chicks are removed from the incubator or a few hours later The chicks appear weak drowsy and puffed up Death usually follows within a few hours A somewhat less acute form may appear a day or two after hatching The chicks exhibit similar symptoms but in addition the navel is covered with a scab which exposes an ulcer if removed
>
> Omphalitis is caused by a variety of bacteria even in each individual outbreak These microorganisms gain entrance to the body of the baby chick through the navel after hatching This bacterial invasion is encouraged by poor sanitation and high humidity of the incubator environment
>
> Although the number of outbreaks are few they create serious problems to the hatcheryman when they do occur Mortality may result in losses of 5 per cent or more of all the chicks hatched
>
> Control measures consist mainly of the use of healthy parent stock and proper incubator sanitation The use of eggs from only pullorum tested parent birds will reduce the egg borne infection An effective fumigant such as formaldehyde gas is an aid in reducing bacterial infections in the incubator
>
> Cheesecloth soaked in formalin which releases formaldehyde gas and hung in the incubator for 3 hours after hatching is simple and an effective method Twenty cc of formalin per cubic foot of incubator space is adequate for normal fumigation In the presence of an omphalitis outbreak the formalin should be increased 3 times the normal amount A slight reduction of humidity of the incubator at hatching time is also beneficial in combating this condition

Taggart (1953) said

> Omphalitis can be identified by the mushy condition of the dead chicks and the very offensive odor

New England but has since been reported in all parts of this country and Australia

Some years we are troubled more with this disease than others, but it appears to be gaining headway in all parts of the country. It could become a serious problem to hatcherymen and breeders . . .

Symptoms are a trembling of the head and neck and ataxia or leg weakness Sometimes the condition might be confused with the nervous phase of Newcastle disease, crazy chick disease or range paralysis

Day old chicks can have the disease, but it is more often seen in chicks 1 to 2 weeks of age

Mortality varies from 0 to 50–60 per cent with an average of 10–15 per cent Not all affected birds die, but recovered birds are stunted and not of much value

Some workers believe the disease to be egg borne or inherited, inasmuch as it can occur in newly hatched chicks

On occasion a hatchery will have several reports of the disease one week and then none the rest of the season

There is no treatment for the disease and the only thing a poultryman can do is remove affected individuals and maintain strict sanitation In some cases where a large percentage of the birds are affected, it will pay to drown or gas the remaining chicks and restock with as near disease free birds as possible

Chronic Respiratory Disease

This is a disease which has caused tremendous losses in mortality and retarded growth in broiler flocks, and has resulted in lowered egg production in breeder flocks C.R.D is very difficult to diagnose, as it resembles air sac infection, Newcastle, and bronchitis Flocks that have a respiratory infection, which hangs on for weeks, and have a poor appetite, should be suspected of C R D, and an accurate laboratory diagnosis should be sought

There is some evidence that the infection is transmitted from the hen to the chick through the egg Turnbull (1953) made a poll of 9 industry scientists, and 6 answered that there is evidence that C R D is egg transmitted, but 3 others of equal ability felt no positive proof had yet been uncovered

To date, antibiotics such as aureomycin, terramycin, and magnamycin have given best results in improving appetites of birds affected with C R D and in bringing about some degree of recovery

Since there is the possibility of egg infection, some are recommending that, in establishing breeding flocks, chicks should be hatched from stock which has no history of C R D These should be hatched separate from possibly infected sources

From the beginning they have had the limitation of not giving solid protection, and the immunity induced was of rather short duration There is no evidence to date to indicate that these limitations have been overcome Although the live virus vaccines are not perfect, they are preferable from the standpoint of higher percentage of birds immunized and longer duration of immunity.

The two live virus vaccines are usually designated as the "stick" (wing web) and intranasal vaccines The "stick" vaccines were developed for use in birds 4 weeks of age up to the age when egg production commences

Their advantage is in their ability to produce a relatively high degree of immunity in many vaccinated flocks

Their limitations are

1 The immunity in numerous flocks is quite variable (that is, some vaccinated flocks have a variable percentage of immune and non immune birds, and the immunity in all birds is not a lasting immunity)

2 They are too potent to be used with safety on chicks younger than 4 weeks of age (As a consequence of the above factor (1), many chicks are in need of increased protection before they are 4 weeks old)

3 They are too potent to be used on laying birds

The intranasal vaccine is a live virus vaccine of very low virulence Its chief advantage is its ability to give added protection to very young chicks and laying flocks without causing serious losses

Its limitations are

1 Because of its low virulence, individual chicks require definite amounts of the virus to insure protection This necessitates careful administration

2 In day old vaccination, the immunity is a low grade immunity which gives a high percentage of protection in broiler flocks but should not be depended upon to carry replacement flocks through the laying season

3 Chicks carrying high levels of antibody as a result of parental immunity are not successfully immunized at 1 day, causing variable percentages of protection in such flocks

In general, under our present immunization program, a relatively small percentage of the breeding flocks transmit sufficient parental immunity to their offspring to seriously interfere with day old vaccination

Because of the many variables which are encountered in a Newcastle control program, it is impossible to recommend a plan which insures the poultrymen complete freedom from Newcastle disease The present vaccines are an aid in controlling disease Because imperfections in vaccines still exist, poultrymen may anticipate changes in the recommendations from time to time directed toward giving more efficient and more effective methods of immunization

Epidemic Tremor

Ellis (1951), commenting on epidemic tremors, states

epidemic tremor or *avian encephalomyelitis* is an acute infection in chicks characterized by tremor like symptoms

The disease, which is caused by a virus, was first observed in flocks in

18

Brooding and Rearing

A sound and well-managed brooding and rearing program is essential to every profitable poultry enterprise. Such a program includes housing, the use of equipment best suited to brooding and rearing, a management program which maintains the proper environment for the chicks, and the control of diseases and parasites.

BROODER HOUSES

The kind of brooder house to use depends upon the climate and the type of poultry enterprise. The housing requirements in the northern states for winter brooding are quite different from those of the South. The kind of brooder house needed by a general farmer keeping a laying flock of 200–300 hens is very different from that of a commercial broiler grower raising several thousand broilers at one time.

Two types of brooder houses are generally used for brooding chicks for flock replacements: the colony house and the large permanent brooder house. Each has a place in the poultry industry.

Movable colony houses 10′ x 12′ built of wood and erected on skids are very generally used on farms where only a few hundred chicks are raised. (See Fig. 18–1.) These houses may be moved near the residence for starting the chicks and brooding them as long as they need heat. The house and chicks can then be moved to clean range. Some growers use a range shelter as a sun porch to the brooder house and then move only the range shelter and the pullets to range. Figure 18–2 shows the use of range shelters.

Large scale egg production enterprises, where several thousand pullets are raised each year for flock replacements, are turning to large permanent brooder houses equipped with either a central heating system or individual stoves. The pullets are usually moved to range and placed in range shelters after they no longer need heat. Some growers are raising pullets in complete confinement without range.

HATCHERY LIABILITY IN DISEASE OUTBREAKS

According to the American Poultry and Hatchery Federation

the tendency on the part of the chick buying public to sue hatcherymen for damages or losses resulting from the purchase of allegedly infected chicks or poults has reached alarming proportions in recent years.

Cognizant of the situation the American Poultry and Hatchery Federation asked its attorney to prepare a model guarantee which hatcherymen can include as a portion of their sales contract and thus make clear to the prospective customer at the outset the extent of the hatcheryman's liability after he has taken normal precautionary steps This guarantee is as follows

GUARANTEE

In the production of these chicks the seller has followed approved and recommended methods of flock control and egg selection and has operated its hatchery according to established sanitary and disease control standards However seller does not warrant these chicks to be free from any disease the existence of which could not be reasonably ascertained at the time of sale

There are several diseases where there is the possibility of egg transmission with no known means of detecting the host carrier where there are no outward symptoms These diseases include C R D , epidemic tremors, Newcastle and leucosis To protect the hatcheryman, the American Poultry and Hatchery Federation attorney recommends that "chick producers adopt the practice of including as a part of their sales contract in each instance a statement expressly denying liability"

TRANSFERRING BREEDING MALES

Frequently it is necessary to transfer breeding males from one flock to another This is very hazardous under the best conditions and should be discouraged as much as possible The flock owner instead should be encouraged to grow his own breeding cockerels

When it becomes necessary to transfer breeding cockerels care should be taken that only visibly healthy birds are transferred and all precautions should be taken to protect the birds in transit so that they will not acquire any respiratory trouble or colds When healthy birds are delivered it is a good practice to have the flock owner sign a statement to the effect that the birds were received in apparently healthy condition Such a statement signed by the flock owner may be helpful in situations which may arise sometime later, if the flock owner's birds happen to contract some disease

This system is practiced in the commercial areas of California where the pullets are raised on wire.

Permanent brooder houses are built 20 feet wide or wider. (See Fig. 18–3.) In some areas, wire-floored, small pen units are used. These permanent brooder houses generally have a concrete foundation, which appears to be desirable to give more permanence to the building and keep out rats, etc. However, some pole-type houses are being built. Until about 1940 concrete floors were generally the rule, but, with the general use of built-up litter, broiler growers have turned

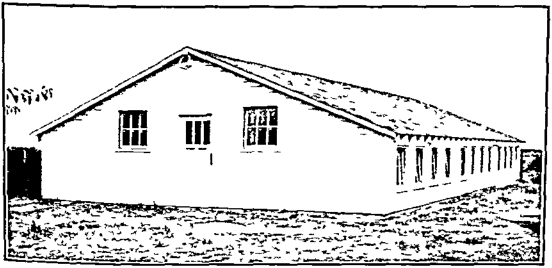

FIG 18–3 Permanent brooder house, 30 ft wide (Courtesy Mo Agr Exp. Sta)

to dirt or gravel floors, since the houses are seldom cleaned. If any attempt is going to be made to clean and disinfect the brooder house between broods or even annually, a concrete floor (thin section type) is desirable. The roof on most brooder houses now being constructed is generally relatively flat and of the built-up type. It is desirable in most parts of the United States (except the South and the Pacific coast) to insulate the roof or ceiling of the brooder house if it is to be used for brooding during the winter.

HEATING SYSTEMS AND METHODS

There are several sources of heat and different methods of heating brooder houses that produce satisfactory results. Individual brooder stoves and central heating systems are both used.

Central heating systems cost more per chick to install, but they are less expensive (fuel cost per chick) to operate. They require less labor

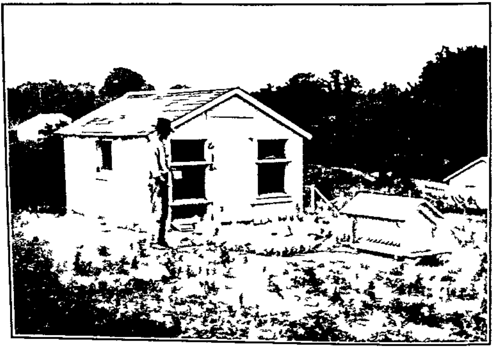

Fig 18-1 Colony brooder house used for brooding and rearing (Courtesy Mo Agr Exp Sta)

Fig 18-2 Range shelters in use where there is pasture and shade (Courtesy Mo Agr Exp Sta)

Chestnut size anthracite coal is best for coal stoves, but it is not always available Briquets of soft coal are commonly used and are satisfactory if the pipe is kept reasonably clean of soot Some experience in operating coal stoves is desirable The beginner will do well to fire such stoves several days before the chicks are to be started and learn to operate them so as to maintain a uniform temperature before the chicks are placed under the hover (See Fig 18–4)

The better coal stoves have a large firebox and magazine and are equipped with rocker grates The ashes should be kept shaken down and the ash pan cleaned out to allow better draft on such stoves

Wood-Burning Brooders Wood-burning brooders were once popular in areas where wood was readily available, but these stoves have lost much of their popularity because of the labor involved in providing the wood and also because some of them require close attention to maintain a satisfactory temperature Some are equipped with reliable thermostats, which do a good job of maintaining the desired temperature When green wood is used, tar may clog the smokepipe

Oil-Burning Brooders These brooders require less labor to operate than coal- or wood burning stoves With thermostatic control they maintain a uniform temperature and provide ample heat to keep the house warm and dry The fuel oil cost of operating such brooders is relatively high, and there is more of a fire hazard than with other types of brooders

Gas Burning Brooders With natural gas being piped throughout the country and bottle gas being widely distributed in rural areas, gas burning brooders have become quite common One stove or many may be operated from a 1-bottle gas tank Different sized bottle gas tanks are available for small or large installations These brooders maintain uniform temperatures and require a minimum of labor to operate They are usually connected to the gas line with a rubber hose and are suspended from the ceiling with a rope and pulley attachment so that they can be adjusted to any height or raised out of the way for cleaning or other work (See Fig 18–5)

They have the disadvantage (1) of not providing enough heat to keep the brooder room warm in cold weather in some brooder houses in the central and northern parts of the United States and (2) of causing more moisture to condense in the house in winter

Electric Brooders With increased use of electricity in rural areas, electric brooders have come into general use They maintain uniform temperature under the hover and require but little attention They do not heat the room, and in cold weather wet litter is more of a problem

and are less of a fire hazard than individual stoves. However, they are only practical for large-scale commercial operations.

Individual stoves are adapted to either small or large operations. They cost less to install than the central heating systems, but they cost more (per chick) to operate. They require more attention and labor than the central systems

Individual Brooder Stoves

Coal Stoves. Of the small units, coal stoves have been employed longer than the other types. They are still quite generally used by

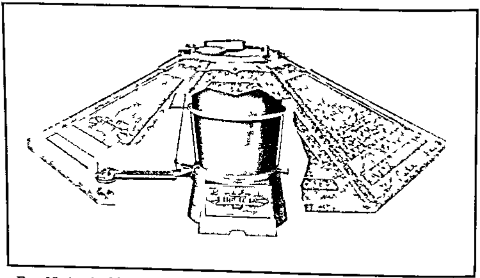

FIG 18–4 Coal burning brooder stove (Courtesy Buckeye Incubator Co)

farmers and by broiler growers, but more recently their popularity in new brooder houses has declined They have the advantage of providing sufficient heat to keep the house warm and dry in cold weather. They require more attention and labor than some of the other brooder units, and this accounts for their decline in popularity.

Coal stoves are provided with thermostats, which control the draft and temperature. These thermostats should be checked sufficiently in advance of the heating of the stove so that defective parts can be detected before the stove is started The smokepipe should have a metal guard, where it passes through the roof, to prevent setting the roof on fire To insure sufficient draft the pipe should extend about 3 feet above the roof. A metal cap over the end of the pipe will help prevent back drafts and rain from running down the pipe. The pipe should also be equipped with a draft damper.

than with coal or oil stoves They are, of course, dependent upon a constant electric current

Infrared Brooding This is a relatively new method for brooding chicks that may find a place in poultry raising Infrared lamps are suspended (18 to 27 inches) above the floor litter These lamps do not heat the air, but instead they warm the chicks as do the direct rays of the sun The comfort of the chicks is the guide to be followed in infrared brooding, and not the thermometer A single 250 watt infrared bulb will provide for 60–100 chicks Multiple units are available or may be constructed with several bulbs per panel Thermostatic controls are desirable on these multiple unit installations to save electricity (See Fig 18–6)

The advantages of infrared brooding are (1) low initial cost (2) require a minimum of labor, (3) easy to install and operate and (4) all chicks can be seen at any time Some of the disadvantages are (1) insufficient heat in cold weather, (2) problem of power interruption and (3) high cost of operation Work reported by the Delaware station showed that infrared brooding resulted in a marked increase in barebacks

Unit Space Heaters Heating units used in heating garages factories, etc , have been adopted for some large scale brooding operations Fans drive air through a radiator heated with steam or hot water and circulate the hot air through the brooder room, thereby warming the entire room The air currents are directed in such a manner as to keep the chicks comfortable and spread out over the floor

Central Heating Systems

Large scale broiler production has created a demand for brooding systems to handle 5,000 to 50,000 or more chicks per house Several central heating systems have been developed for this purpose These systems use either coal or oil for fuel Automatic stokers on coal fired furnaces reduce labor and make for even heating The oil fired furnaces cost less to install, but with prevailing prices of coal and oil they are more expensive to operate than coal fired furnaces

Hot Water Heat This type of brooding system has given satisfaction in large-scale operations for many years Hot water pipes (1¼") spaced 4 to 6 inches apart and about 14" above the floor circulate the hot water (170 to 190°F) Circulators (pumps) circulate the water A thermostat controls the circulators and an aquastat which regulates the fire controls the temperature of the water The hot water system

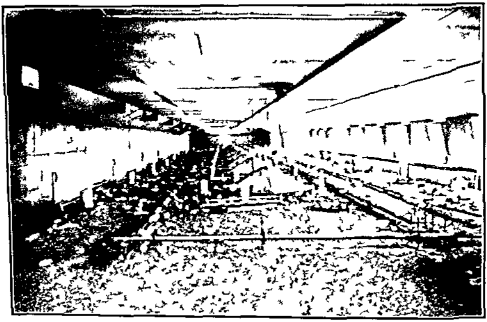

Fig 18-5 Gas burning brooder stoves in use (Courtesy James Manufacturing Co)

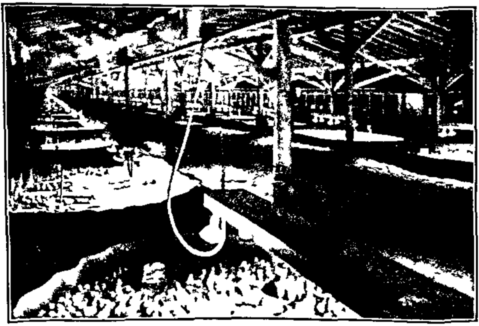

Fig 18-6 Infrared brooding (Courtesy General Electric Co)

sales for holding surplus chicks, or for chick feeding experiments, etc. Their use for starting pullets intended for flock replacements is limited for best results to the first 3 or 4 weeks of the chick's life. Broilers may be grown in batteries if they are to be killed and dressed on or near the premises.

There was a time when batteries served extensively in brooding 3 week old started pullets. Excessive express rates have almost eliminated the started chick business where shipping is required. Respiratory diseases may cause serious trouble in started chick plants and may be spread to farms purchasing started chicks.

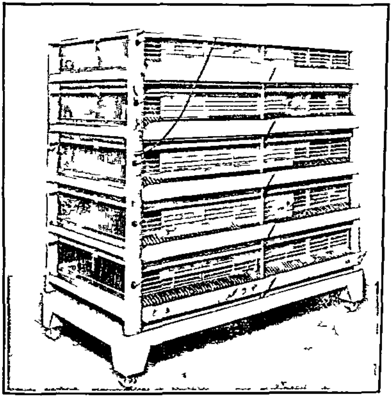

FIG. 18–7. Battery brooders for starting and brooding chicks for about 3 weeks. (Courtesy James Manufacturing Co.)

Type of Brooder and Sexual Maturity. The Pennsylvania station has studied the relationship of the kind of brooder used and the age at first egg. They found that Leghorn pullets brooded with coal stoves or a hot water brooding system began laying at an average of 152–155 days of age, as compared to 173 days when brooded with electricity, or 165 days when raised to 12 weeks of age in batteries.

It is evident from these data that sexual maturity (age of first egg) was delayed by electric brooding. In this experiment they were unable to delay sexual maturity by heavy grain feeding.

of brooding holds heat well and maintains a uniform supply of heat Installation costs are high, but fuel cost per chick is very low

Radiant Hot Water Systems Hot water pipes above the floor are very much in the way when cleaning and when catching chickens Some operators have built houses with the hot water pipes buried in the concrete floor This has been called radiant heating It is an expensive system to install because it requires a concrete floor (not generally used now) and a central hot water heating system These costs may be as great as the other costs of the house Since the newness has worn off the idea of radiant heating and it has not fulfilled all claims made by its advocates it has lost most of its popularity

Central Hot Air Heat The system may be either direct or indirect. In the direct hot air system the air is heated by a hot air furnace and distributed through a central duct to the chicks, pipes lead off from the central duct at 15-foot intervals to about 15–18 inches from the floor (no hover is used)

Another type of direct hot air heating circulates the hot air through a central duct (12 inch pipe) beneath a hover Holes in the top of the pipe permit the hot air to escape and be deflected down to the chicks by the hover

An indirect warm air heating system has been built by some large scale (20 000 to 40 000 broilers) operators Steam is piped from a furnace to the center of the pen where a heat exchanger is located Fresh air is heated by a fin type steam radiator The hot air is then blown through a central duct and distributed as described above for the direct hot air system

Battery Brooding

After Vitamins A and D were discovered and incorporated in poultry rations it was possible to raise chickens in complete confinement away from direct sunlight These developments made possible the brooding of chicks in battery brooders

Types of Battery Brooders There are two general types of battery brooders (1) the unheated brooders made for warm rooms and (2) those equipped with heating units and warm compartments for rooms held at 60 to 70°F Most batteries in use today for young chicks have heating units which are heated by electricity, and each compartment is equipped with a thermostat for regulating the temperature They are of the type shown in Fig 18–7

Use of Battery Brooders Battery brooders may be used for starting chicks for flock replacements for broiler production for started chick

Table 18–2 Manufacturers' domestic shipments of brooders, by type, for selected years *

Year	Floor Type (thousands)						Battery Type (Heated)
	Electric	Oil	Coal	Gas	Wood	Total	
1940	91	115	33	4		243	9
1943	144	197	92	10	25	468	23
1946	141	172	36	30	6	385	76
1949	84	66	35	90		275	60

* Data from the Bureau of the Census

Table 18–3 Percentage of all chickens raised, 1949, that were brooded with heat from each of several sources *

Section	Source of Heat					
	Electricity †	Oil	Coal †	Gas	Wood	Hens
Northeast (New England, N Y, N J, Penn, Del, Md)	22	10	57	8	2	1
Corn Belt (Ohio, Ind, Ill, Iowa, Mo)	44	31	9	6	4	6
Lakes States and Great Plains (Mich, Wis, Minn, N D, S D, Neb Kan)	32	48	5	6	1	8
Appalachian (W. Va, Ky, Tenn, Va, N C)	22	18	20	4	21	15
Southeast (S C, Ga, Fla, Ala)	19	41	16	10	6	8
South (Miss, La, Ark, Okla, Texas)	18	32	2	29	6	13
Mountain (Mont, Ida, Wyo, Colo, N M, Ariz, Utah, Nev)	36	37	8	5	1	13
Pacific (Wash, Ore, Calif)	61	22	3	11	1	2
United States	29	27	21	10	6	7

* From a survey of 20,000 farms by the U S Department of Agriculture

† In mild climates electric brooders were more popular, 61 per cent of the farms surveyed on the Pacific coast used electric brooders Fifty-seven per cent of the chicks raised on farms in New England and the North Atlantic states were brooded with coal stoves

AN EVALUATION OF BROODING SYSTEMS

The Delaware station (1951) reported the results of studies made of types of brooding for the production of broilers (Table 18–1) They

Table 18–1 Comparative costs of installing and operating different brooding systems *

System	Installation Cost (cents) per Chick	Fuel Cost (cents) per Chick Started
Central		
Hot water (coal fired)	20–25	0 6
Hot water (oil fired)	20–25	1 0
Direct hot air (oil fired)	16–20	1 5
Indirect warm air (coal fired)	12 18	1 0
Infrared	18–20	2 7
Individual stoves		
Oil	7	2 3
Coal	8	1 9
Gas	9–11	1 6
Electric	10	1 5

* From *Delaware Agr Exp Sta Bul* 50 November 1950

compared gas, oil, central hot air, infrared, and coal From their ex periments they concluded

In this experiment gas heated brooders gave production results equal to individual coal heated brooders but the cost of gas fuel was greater by 26 8 per cent

Oil burning brooders produced higher average final broiler weight in two trials than did individual coal stoves When the results of the two trials are combined mortality was slightly lower in the oil brooded broilers than in the coal brooded pens The value of the increased weight of poultry produced indicates that oil burning brooders are slightly more efficient than individual coal burning brooders Oil burning brooders have the added advantage that they should require less labor to operate

The central hot air system of brooding broilers gave results comparable to the results with individual coal burning brooders Observations would indicate that the effectiveness of the hot air system would be greatly en hanced if installed in a well insulated broiler house

The use of infrared bulbs in brooding broilers resulted in an increase in the number of poorly feathered birds and an increase in the fuel costs as compared with individual coal burning brooder stoves There was little difference between the two systems of brooding in broiler mortality, average final weight, and feed required per pound of broiler sold

A relative evaluation of the brooding systems studied based upon broiler production results fuel costs and general observations would seem to justify

The high body temperature of the chicken that results in death is about 117°F. The California station has reported that chicks held in sealed summer-size fiberboard chick boxes in a room kept at 100°F. suffered losses of 20 to 50 per cent. Leghorn chicks suffered less than New Hampshire chicks.

Chilling is also detrimental to the chicks and may result in heavy losses. Chicks infected with pullorum suffer much more from chilling than pullorum-clean chicks. Chilling may affect the lungs and result in paralysis of the breathing mechanism. Chicks that are chilled tend to crowd and pile, sometimes resulting in heavy losses. Diarrhea may be caused by chilling and growth may be retarded. The low body temperature lethal to day-old chicks is about 60°F. The Maryland station reported experiments in which they found that chicks (0–4 days old) exposed for 30 to 40 minutes at 10°F. died from such exposure. Older chicks (18–20 days) died after 70–80 minutes of such exposure. The low lethal body temperature was found to be 60°F. in the day-old chick and to increase progressively to 72°F. when the chicken was mature.

Ventilation

Fresh air is essential to the developing chick and ventilation is necessary to keep the house reasonably dry. Carbon monoxide may be formed by defective combustion of such fuels as gas, oil, and coal, and if this gas accumulates to a concentration of 0.01 per cent slow poisoning may occur. A laboratory examination of the blood is necessary to determine carbon monoxide poisoning.

If sufficient ventilation keeps the litter reasonably dry the chicks will have an adequate supply of fresh air. Enough fresh air should be admitted and circulated in the brooder house to keep the litter reasonably dry and to eliminate foul odors. If this is done the chicks will suffer no ill effects from harmful gases. Ammonia fumes from built-up litter and droppings may become quite obnoxious in tightly closed brooder houses. Such fumes irritate the chicks' eyes.

Moisture

Too much or too little moisture in the brooder house can cause trouble. If the litter or walls and ceiling become wet there is too much moisture in the brooder house, and steps should be taken to reduce it. Wet litter may lead to an outbreak of coccidiosis or other diseases. The litter must be kept reasonably dry (Fig. 18–8). By increasing ventilation the condition of the litter can be improved and kept reason-

the following order (1) central hot air, (2) oil stoves, (3) individual coal stoves, (4) gas stoves, and (5) infrared bulbs

Popularity of Different Types of Brooders

New types of brooders come into the market and become popular while other kinds lose their popularity The Bureau of the Census reports some very interesting figures of manufacturers' shipments of brooders within the United States from 1940 to 1949

From these data (see Table 18–2) it is evident that wood burning brooder stoves lost their market whereas demand for gas burning brooders increased The demand for electric, coal, and oil brooders declined The sales of battery brooders in 1949 remained relatively high

A survey made by the United States Department of Agriculture in 1949 (see Table 18–3) showed that farmers in different parts of the country favored different kinds of brooders

CONTROL OF ENVIRONMENTAL CONDITIONS IN BROODING

There are certain environmental conditions which must be controlled when brooding chicks They are temperature, ventilation, humidity, sanitation, and space

Temperature

There are optimum temperatures for chicks of different ages Too high or too low temperatures will slow down the growth rate and may even cause death at extreme temperatures The most satisfactory arrangement appears to be to have a range of temperature of 95–100°F, down to 60°F available to the day old chicks so they may choose the most comfortable temperature Young chicks must have some source of heat for the first few weeks of their lives, the amount and time depending upon environmental temperature conditions Experiments at the Beltsville Agricultural Research Center (1947) showed that maximum growth and feed efficiency was obtained when the temperature was started at 94°F on the first day and reduced uniformly to 80°F on the eighteenth day Thus the common recommendation of starting the brooder at 95°F (2 inches above the litter at the edge of hover) and gradually reducing the temperature about 5 degrees each week is well founded The most important factor in brooding is keeping the chicks comfortable and avoiding extremes in temperature

to be brooded on old litter) Fresh, clean litter should be added to 2 or 3 inches in depth Shavings, sawdust, crushed corn cobs, peat moss, sugar cane pulp, or other absorptive materials may be used as litter

The question of old *vs* fresh litter is still debatable, with many growers favoring old litter and most veterinarians opposed Growers like it because of the labor saved Veterinarians are opposed to it because of the disease and parasite hazards Old litter, particularly in the South becomes infested with worms, coccidia (if the litter becomes wet), and other organisms If it is used the chicks must be wormed frequently The fact that old litter does contain some nutritional factors (B_{12}, riboflavin, and possibly other factors) not found in fresh litter is probably more than offset by the diseases and parasites it contains

Whatever fresh litter is used must be clean, dry, free of mold, and not dusty The mold *aspergillosis fumigatus,* sometimes found in litter or feed, may cause heavy losses from what is commonly called brooder pneumonia

Young chicks and poults sometimes die from crop impaction resulting from eating litter To prevent this the litter may be covered with newspapers Such papers may be left on the floor to be torn up by chicks and mixed with the litter In fact, they serve to attract the chicks to the hover at night, as they tend to gather on the newspapers However, if the chicks are not too hungry when they are placed in the brooder and feed is kept before them, no difficulty will be experienced Feed and water should be ready for the chicks when they are placed in the brooder A good way to start chicks eating is to place feed on egg cup flats, newspapers, chick box lids turned upside down and covered with paper, or cut down chick boxes

A Comparison of Litters The Delaware station compared several litters used for brooding broilers, from which they concluded

1 For use in broiler production, litters of organic origin were found to be superior to litters of inorganic origin

2 Litters of inorganic origin or mineral litter, increase dustiness in broiler pens, which in turn increases the severity of respiratory diseases

3 Based upon broiler production factors and observations the 12 litters studied may be ranked in the following order peanut shells ground corn cobs peat moss sugar cane fiber, sawdust, shavings, cottonseed hulls corn stalks, dryzone, sand chick bed and Georgia mineral litter

4 The best litter for broiler production is one that is of organic origin dry, fine in texture light in weight relatively free of dust, low fire hazard, and relatively low in price

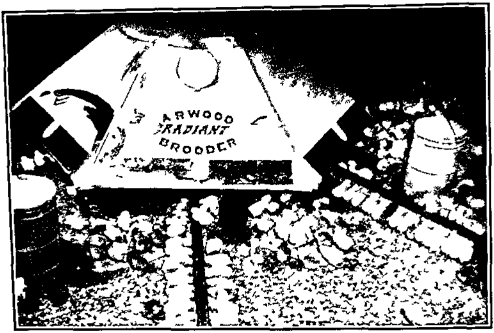

FIG 18–8 Chicks started on dry, deep litter (Courtesy Mo Agr Exp Sta)

ably dry If moisture condenses on the ceiling and walls until it drips, better insulation as well as ventilation is needed

A brooder house can also be too dry for best results A fairly humid (50 to 60 per cent R H) environment is conducive to good feathering A very dry atmosphere will result in poor feathering

Space

For best results in brooding, the chicks should have plenty of floor space A good rule to follow is to allow ½ sq ft of floor space per chick and to increase the floor space by ½ sq ft per chicken each 4 weeks until the pullets are ready to go to the laying house, where they should have 3–4 sq ft of floor space per bird

MANAGEMENT IN BROODING

Proper brooding management is essential to raising healthy pullets or broilers

Litter

Several days before the chicks are placed in the brooder house the house should be thoroughly cleaned and disinfected (unless chicks are

to be brooded on old litter). Fresh, clean litter should be added to 2 or 3 inches in depth. Shavings, sawdust, crushed corn cobs, peat moss, sugar cane pulp, or other absorptive materials may be used as litter.

The question of old *vs.* fresh litter is still debatable, with many growers favoring old litter and most veterinarians opposed. Growers like it because of the labor saved. Veterinarians are opposed to it because of the disease and parasite hazards. Old litter, particularly in the South, becomes infested with worms, coccidia (if the litter becomes wet), and other organisms. If it is used the chicks must be wormed frequently. The fact that old litter does contain some nutritional factors (B_{12}, riboflavin, and possibly other factors) not found in fresh litter is probably more than offset by the diseases and parasites it contains.

Whatever fresh litter is used must be clean, dry, free of mold, and not dusty. The mold *aspergilliosis fumigatus*, sometimes found in litter or feed, may cause heavy losses from what is commonly called brooder pneumonia.

Young chicks and poults sometimes die from crop impaction resulting from eating litter. To prevent this the litter may be covered with newspapers. Such papers may be left on the floor to be torn up by chicks and mixed with the litter. In fact, they serve to attract the chicks to the hover at night, as they tend to gather on the newspapers. However, if the chicks are not too hungry when they are placed in the brooder and feed is kept before them, no difficulty will be experienced. Feed and water should be ready for the chicks when they are placed in the brooder. A good way to start chicks eating is to place feed on egg cup flats, newspapers, chick box lids turned upside down and covered with paper, or cut down chick boxes.

A Comparison of Litters. The Delaware station compared several litters used for brooding broilers, from which they concluded:

1. For use in broiler production, litters of organic origin were found to be superior to litters of inorganic origin.
2. Litters of inorganic origin, or mineral litter, increase dustiness in broiler pens, which in turn increases the severity of respiratory diseases.
3. Based upon broiler production factors and observations the 12 litters studied may be ranked in the following order: peanut shells, ground corn cobs, peat moss, sugar cane fiber, sawdust, shavings, cottonseed hulls, corn stalks, dryzone, sand, chick bed, and Georgia mineral litter.
4. The best litter for broiler production is one that is of organic origin, dry, fine in texture, light in weight, relatively free of dust, low fire hazard, and relatively low in price.

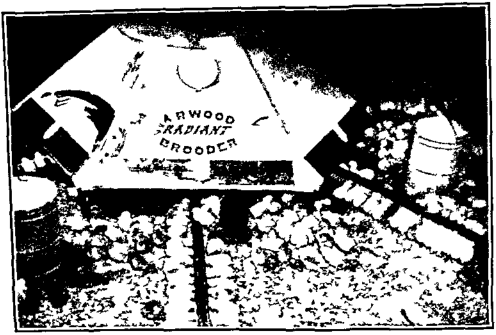

Fig 18–8 Chicks started on dry deep litter (Courtesy Mo Agr Exp Sta)

ably dry If moisture condenses on the ceiling and walls until it drips better insulation as well as ventilation is needed

A brooder house can also be too dry for best results A fairly humid (50 to 60 per cent R H) environment is conducive to good feathering A very dry atmosphere will result in poor feathering

Space

For best results in brooding the chicks should have plenty of floor space A good rule to follow is to allow ¼ sq ft of floor space per chick and to increase the floor space by ½ sq ft per chicken each 4 weeks until the pullets are ready to go to the laying house where they should have 3–4 sq ft of floor space per bird

MANAGEMENT IN BROODING

Proper brooding management is essential to raising healthy pullets or broilers

Litter

Several days before the chicks are placed in the brooder house the house should be thoroughly cleaned and disinfected (unless chicks are

mechanical feeding is only another method of feeding, that close super vision is needed, and that such feeders cannot entirely replace man, who is the key to success in either mechanical or hand feeding

Within recent years, bulk feeding has developed Large trucks handling several tons of feed, equipped with conveyors, move the bulk feeds directly from the feed mill to the grower's feed bins, to which mechanical feeders may be connected Bulk feeding is adapted to rela tively large scale operations only

Water

Fresh water at all times is necessary for satisfactory growth and efficient utilization of feed This is frequently neglected where only a few chicks are brooded Broiler growers realize the importance of fresh water and provide either running water or water under pressure with automatic controls to provide fresh water all the time

One of the drudgeries of raising a small flock on the general farms has been the carrying of water With the widespread use of electric pumps and pressure systems of water supply on farms, water is being piped to more brooder houses and to the range where pullets are raised Where electricity is not available or where the range is too far from the water supply to make a water line practical, barrel type waterers with a float may be used to provide water with a minimum of labor

Quart jar water founts are suitable for starting chicks and 3 to 5 gallon glass or metal water fountains are useful during the brooding period when the chicks need heat A 3 or 5 gallon waterer will care for 100 chicks Later, on range, a barrel waterer with a float valve will take care of 150 to 200 pullets

RANGE VS CONFINEMENT WHEN RAISING PULLETS

Broiler producers now raise millions of broilers annually in complete confinement and apparently with better success (more efficient gains) than with birds given some range Certain commercial growers no tably in the more concentrated areas of California, raise their pullets on wire and in complete confinement Though there is difference of opinion on this subject, where clean range is available, it is best to grow pullets on range The work of the Ohio station substantiates this recommendation From an experiment with 2 000 New Hampshire chicks grown and held in confinement through the first laying year they concluded

Feeding

One of the major problems in raising young stock or broilers is to get the most efficient gains or feed utilization The ration and the rate of growth of the stock are most important factors affecting feed conversion The method of feeding and the feeder (human element) are also very important

Self feeders are generally employed for replacement stock and especially on range They save labor in feeding and, if kept filled provide

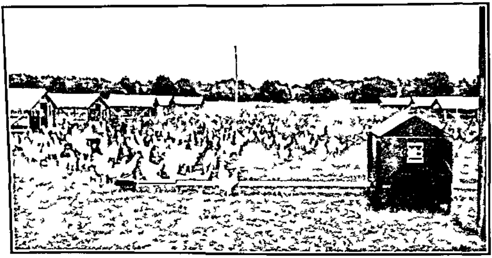

FIG 18–9 Automatic poultry feeder on range This feeder operated all summer out of doors as shown The only attention it received was to be stopped just before a heavy rain storm (Courtesy Automatic Poultry Feeder Co)

feed at all times Three 8 ft trough type feeders will provide sufficient feeding space for 100 growing pullets

For most economical results, hand feeding has been found to give better gains and better feed conversion than self feeders Therefore, most broiler growers have abandoned self feeders and turned to hand feeding in troughs The better feeders continue to work through the house, adding fresh feed or stirring the mash in the troughs Such feeding encourages feed consumption

Mechanical feeders in large scale broiler enterprises have been quite generally adopted in recent years (Fig 18–9) Owing to mechanical difficulties and for other reasons, some growers have abandoned mechanical feeders If properly used, mechanical feeders give as satisfactory results as hand feeding However, it should be realized that

mechanical feeding is only another method of feeding, that close supervision is needed, and that such feeders cannot entirely replace man, who is the key to success in either mechanical or hand feeding

Within recent years, bulk feeding has developed Large trucks handling several tons of feed, equipped with conveyors, move the bulk feeds directly from the feed mill to the grower's feed bins, to which mechanical feeders may be connected Bulk feeding is adapted to relatively large scale operations only

Water

Fresh water at all times is necessary for satisfactory growth and efficient utilization of feed This is frequently neglected where only a few chicks are brooded Broiler growers realize the importance of fresh water and provide either running water or water under pressure with automatic controls to provide fresh water all the time

One of the drudgeries of raising a small flock on the general farms has been the carrying of water With the widespread use of electric pumps and pressure systems of water supply on farms, water is being piped to more brooder houses and to the range where pullets are raised Where electricity is not available or where the range is too far from the water supply to make a water line practical, barrel type waterers with a float may be used to provide water with a minimum of labor

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RANGE *VS* CONFINEMENT WHEN RAISING PULLETS

Broiler producers now raise millions of broilers annually in complete confinement and apparently with better success (more efficient gains) than with birds given some range Certain commercial growers, notably in the more concentrated areas of California, raise their pullets on wire and in complete confinement Though there is difference of opinion on this subject, where clean range is available, it is best to grow pullets on range The work of the Ohio station substantiates this recommendation From an experiment with 2,000 New Hampshire chicks grown and held in confinement through the first laying year they concluded

There was no significant difference in body weight, feed consumption, or mortality of pullets grown on grass range and in confinement during the age period 9–20 weeks.

Egg production of the range-reared pullets, during the age period 21–66 weeks, was 33,964 eggs, or 41.5 per cent, whereas the confinement-reared birds laid 26,526 eggs or 36.6 per cent.

Eggs laid by pullets which had been reared on range were a little larger than those from confinement-reared pullets.

There was no difference in the hatchability of fertile eggs from the range- and confinement-reared birds.

Mortality of the range-reared pullets, during the 44-week laying period and on a hen-day basis, was 11.3 per cent, and of the confinement-reared group, 21.5 per cent.

This experiment showed that pullets raised on range laid at a higher rate of production, and the mortality among them was much lower than that of similar stock raised in confinement. It is generally recognized that there are unknown vitamins in succulent green feed and possibly the birds raised on range were benefited by some of the unknown factors.

DISEASE CONTROL

By proper management practices many diseases can be prevented and prevention is much better than treatment of disease.

Pullorum

Since the carriers of this disease can be detected by the agglutination blood test, the reactor birds can be located and removed from the breeding flocks. This disease has practically been eliminated from poultry flocks in the United States by breeders and hatcheries participating in the National Poultry Improvement Plan and others following a similar program of eradication. U.S. pullorum-passed or clean chicks are reasonably safe from pullorum. There is no satisfactory treatment for this disease. The only safeguard is to start with clean chicks. The poultryman cannot afford to take a chance with chicks from flocks that have any pullorum in them. See Chapter 17 for more details on this disease.

Air Sac Infection

This new trouble has hit the broiler industry, first starting in the more concentrated areas but spreading to large-scale operations in many areas. Very little is known about this disease as yet, but it is causing very heavy losses. The only safe recommendation would ap-

There was no significant difference in body weight, feed consumption, or mortality of pullets grown on grass range and in confinement during the age period 9–20 weeks

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Eggs laid by pullets which had been reared on range were a little larger than those from confinement reared pullets

There was no difference in the hatchability of fertile eggs from the range- and confinement reared birds

Mortality of the range reared pullets, during the 44 week laying period and on a hen-day basis, was 11 3 per cent, and of the confinement reared group, 21.5 per cent

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pear to be a program of sound flock management, including rigid sanitation and quarantine as far as possible

Worms

With the introduction of built-up litter has come worm infestations in young chicks If built up litter is used in the midwestern and southern states, the young chickens must be wormed beginning at about 4 weeks of age A standard treatment is the application of tobacco dust, as follows 2 per cent in the mash for 2 days, and repeat this treatment within 19 to 21 days

Coccidiosis

This disease is very widespread in poultry and most growers can anticipate having an outbreak in their young stock The sulfa drugs have proved especially effective in controlling this disease, so that it is not the scourge it once was The drugs for combating the disease may be incorporated in the mash and used as a preventive Many producers prefer to try to prevent the disease by sanitation, and by avoiding contamination from outside sources, and resorting to drugs when the disease appears in the flock

Sulfaquinoxiline is commonly used as a treatment for coccidiosis It may be placed in the drinking water or in the mash

The Ohio station reports less trouble from coccidiosis when built up litter is properly used However, if the litter becomes wet an outbreak of coccidiosis is almost sure to follow Warm and humid weather are conducive to the development of coccidiosis

Cannibalism

Cannibalism may cause losses in young chickens both by toe picking during the early brooding period and by tail picking later It is more of a problem when chickens are overcrowded, in close confinement, and in brightly lighted pens or batteries

An effective control measure against cannibalism is to darken the room or pen All injured birds should be removed as soon as detected, the injured parts treated with tar or other antipick mixtures, and kept isolated for several days Other helpful measures are provide more room, give the birds access to yards or range, and remove the birds causing the trouble if they can be located Direct rays of the sun shining on white feathered birds will often cause trouble, the birds see the pink (blood) in the newly formed feathers and start picking

There was no significant difference in body weight feed consumption or mortality of pullets grown on grass range and in confinement during the age period 9–20 weeks

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Piling

A very annoying trouble that sometimes arises during the brooding period is crowding or piling which results in the death of many chicks This trouble may become a habit that persists for several weeks Dim lights under the hover and in the house will help prevent this trouble If proper brooding conditions prevail this trouble will not develop

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